



Deposited via The University of Leeds.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/136443/>

Version: Accepted Version

Article:

Schulz, C, Martin-Ortega, J and Glenk, K (2018) Value landscapes and their impact on public water policy preferences. *Global Environmental Change*, 53. pp. 209-224. ISSN: 0959-3780

<https://doi.org/10.1016/j.gloenvcha.2018.09.015>

Reuse

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

1 Value landscapes and their impact on public water policy preferences

2

3 Abstract

4 A growing body of research suggests that people's values may be important predictors of their
5 preferences regarding water governance and policy. However, this assertion is rarely tested
6 empirically. The present study summarises the results of a large-scale quantitative study on the link
7 between public water policy preferences and people's values, based on data from a representative
8 sample of the general population collected in a household survey in the Upper Paraguay River Basin,
9 Mato Grosso, Brazil (n=1067). Structural equation modelling is applied to represent the clusters of
10 values, or 'value landscapes', that shape attitudes and water policy preferences, in this case, for or
11 against the construction of the highly controversial Paraguay-Paraná Waterway across the Pantanal
12 wetland. Results demonstrate that opponents of the waterway share a value landscape composed of
13 closely related self-transcendence values, democratic governance-related values, and ecological and
14 cultural water values, whereas supporters hold self-enhancement values, economic governance-
15 related values, and economic water values. Beyond this individual case study, our findings may explain
16 the protracted nature of, and seeming impossibility to resolve, environmental conservation vs.
17 economic development conflicts more broadly.

18

19 Keywords

20 Environmental values; value landscapes; political legitimacy; Paraguay-Paraná Waterway; Pantanal;
21 Mato Grosso; Brazil

22

23 1 Introduction

24 It has been argued that studying values can help to better understand water governance and water
25 policy, may potentially contribute to mitigating conflicts in water governance, and help to assess the
26 political legitimacy of water policy (Bjornlund et al. 2013; Glenk & Fischer 2010; Groenfeldt 2013;
27 Grotenbreg & Altamirano 2017; Hermans et al. 2006; Ioris 2012; Pradhananga et al. 2017; Salvaggio
28 et al. 2014; Sanderson et al. 2017; Schulz et al. 2017a). There are a number of alternative theoretical
29 conceptualisations of values, typically delimited by disciplinary boundaries (Dietz et al. 2005; Ioris
30 2012; Lockwood 1999; Schulz et al. 2017a).

31 One of the many existing conceptualisations is associated with environmental and social psychology,
32 where values are understood as abstract guiding principles (fundamental values) that may influence
33 human decision-making, attitudes, and behaviour, such as e.g. biospheric values, which emphasise
34 caring about the intrinsic value of nature and the environment and may be associated with pro-
35 environmental behaviour (Dietz 2016; Fulton et al. 1996; Rokeach 1973; Schwartz et al. 2012; Steg
36 2016).

37 Alternatively, values may be assigned to objects and places (Brown 1984; Chan et al. 2012; Ives &
38 Kendal 2014; Lockwood 1999), for example water resources (Seymour et al. 2011), nowadays often
39 conceptualized as water ecosystem services, e.g. water supply or electricity generation (Grizzetti et al.
40 2016; Hackbart et al. 2017; Martin-Ortega et al. 2015; Small et al. 2017). Assigning values in this way
41 is common to a number of disciplines, including ecological and environmental economics, and human
42 geography, among others (Brown 1984; Chan et al. 2012; Ives & Kendal 2014; Lockwood 1999).

43 For the applied field of water governance, some scholars have suggested to study a third category of
44 values (Glenk & Fischer 2010; Schulz et al. 2017a; Schulz 2018), i.e. governance-related values, which
45 are those values that express desirable characteristics of water governance, e.g. efficiency or social
46 justice. Such values are currently often the topic of normative work on good governance principles
47 (Akhmouch & Correia 2016; Lockwood et al. 2010; Mostert 2015).

48 There are relatively few attempts to systematically integrate these different branches of the
49 environmental social science literature, hampered not least by the use of different terminologies and
50 by misunderstandings that can result from the multitude of potential meanings of the term 'value'
51 (Brown 1984; Lockwood 1999; Pascual et al. 2017; Tadaki et al. 2017). In this context, Schulz et al.
52 (2017a) have proposed an interdisciplinary conceptual framework that describes the complex
53 relationships between different types of values and their links with water governance metaphorically
54 as 'value landscapes' (Schulz et al. 2017a, 2017b) that forms the theoretical basis for the present study.

55 The value landscapes metaphor serves as a short-hand reference for groups of values that are
56 frequently connected to each other in people's minds, i.e. values that should be closely linked to each
57 other cognitively, but less closely to other groups of values, e.g. 'economic efficiency' as a governance-
58 related value might be linked with 'hydro-electrical power production' as an assigned value and
59 'power' and 'achievement' as fundamental values (Schulz et al. 2017a). Thus, value landscapes
60 simultaneously incorporate the abstract level of fundamental values and principles, the more concrete
61 level of assigned values of water and the environment, as well as the level of values implicit in
62 governance. The conceptual innovation of the Value Landscapes Approach lies in this simultaneous
63 consideration of said three types of values (fundamental values; governance-related values; assigned
64 values), their interrelations, and links to water governance, including water policy preferences, as
65 further explained in section 2.

66 The water policy case study investigated in this article is the controversy over the Paraguay-Paraná
67 Waterway, a water infrastructure project that would engineer the Paraguay River of Mato Grosso,
68 Brazil, to facilitate year-round aquatic transport with large barges, and to connect Brazil's interior with
69 global shipping routes (ANTAQ 2013; Figueiredo et al. 2012; Hamilton 1999; UFPR/ITTI 2016). In many
70 ways, this project represents a classical environmental conservation vs. economic development
71 conflict, given that it would impact the biodiversity of the world's largest freshwater wetland, the
72 Pantanal (Fearnside 2001; Gottgens et al. 2001; Ioris 2013; Junk et al. 2006), but is advocated to
73 accelerate economic integration of South American countries (Gioia 1987; Pires & da Silva 2009), as
74 well as economic growth in Mato Grosso's agribusiness sector (ANTAQ 2013; Arévalo 2015).

75 To investigate the relationships between types of values and water policy preferences, we employ
76 structural equation modelling (SEM). SEM is an established method to understand attitudes and
77 behavioural intentions in the context of applied social and environmental psychological studies (see
78 e.g. Kaida & Kaida 2016; Rahnama & Rajabpour 2017; Shin et al. 2017; Toma et al. 2011) and it allows
79 to uncover complex relationships between latent constructs such as values (Garson 2015; Kline 2011).

80 With regard to water-related issues, a number of studies have focussed specifically on understanding
81 psychological factors motivating support for water conservation and protection behaviour using SEM.
82 These include beliefs and worldviews (Corral-Verdugo et al. 2008), attitudes and awareness (Cooper
83 2017; Floress et al. 2017; Yazdanpanah et al. 2014), perceptions (Hurlimann et al. 2008; Tang et al.
84 2015; Yazdanpanah et al. 2014), perceived behavioural control and norms (Cooper 2017; Yazdanpanah
85 et al. 2014), as well as people's values (Pradhananga et al. 2017), within theoretical frameworks
86 including modifications of the Theory of Planned Behaviour (Ajzen 1985, 1991), Values-Beliefs-Norms

87 Theory (Dietz 2016; Stern et al. 1999), or of the Cognitive Hierarchy model (Fulton et al. 1996; Homer
88 & Kahle 1988; Vaske & Donnelly 1999).

89 Pradhananga et al.'s (2017) integrated moral obligation model, for example, highlights the positive
90 association of collectivistic values (i.e. prioritising group goals over personal goals, and defining 'self'
91 primarily as part of a group) and biospheric-altruistic values (i.e. of caring about the environment for
92 its own sake as well as for improved human welfare) with people's norms (e.g. "I feel a personal
93 obligation to use conservation practices on my land/property."); Pradhananga et al. 2017: 217)
94 regarding water conservation behaviour. However, beyond the specific issue of water conservation
95 there is a paucity of empirical evidence on the link between values and water policy preferences of
96 the general public. An exception is Glenk and Fischer (2010), who investigated links between
97 fundamental and governance-related values, beliefs, attitudes, and willingness to pay for flood
98 mitigation.

99 The present study makes an empirical contribution to the interdisciplinary literature on values, water
100 governance, and water policy by presenting the first attempt to test the aforementioned Value
101 Landscapes Approach using quantitative methods. It is also the first large-scale study on people's
102 values and public water policy preferences in Latin America. It builds on previous qualitative research
103 on the value landscapes of major stakeholders from water-related sectors in the area (Schulz et al.
104 2017b), seeks to operationalise value landscapes for quantitative survey research, as well as to test
105 their impact on water policy preferences using SEM techniques, based on survey data collected in a
106 representative household survey in the Upper Paraguay River Basin, Mato Grosso, between April and
107 June 2016. This article thus shows how the framework can be operationalised, and demonstrates its
108 real-world relevance of providing a better understanding of water-related conflicts, and eventually of
109 pathways for their resolution. By incorporating concepts from a wide range of literatures and
110 disciplines, we also seek to contribute to interdisciplinary scholarship in general, despite the
111 challenges associated with combining thoughts from various research traditions that may have
112 different epistemological backgrounds and terminologies (Lockwood 1999; Norton 2017; Pascual et al.
113 2017).

114

115 **2 The Value Landscapes Approach: Conceptual overview**

116 The Value Landscapes Approach was introduced by Schulz et al. (2017a, 2017b) and refers to a
117 conceptual framework that aims at 'mapping' people's values with the objective of achieving a better
118 understanding of their positions and preferences in water governance, including in situations of
119 conflict. The purpose of the Value Landscapes Approach is to systematise our understanding of the
120 role of values in water governance from an interdisciplinary perspective. The metaphor of 'value
121 landscapes' for groups of closely related values does not refer to actual geographical landscapes, but
122 cognitive landscapes of values that are related in people's minds, inspired by the fact that landscapes
123 are typically defined by the features of connectivity and (physical) closeness of various elements, e.g.
124 in ecology (Taylor et al. 1993).

125 Justification for the introduction of a new conceptual framework were i) that many existing studies
126 apply a single theoretical, monodisciplinary perspective, despite potential additional insights that may
127 arise from combining the findings of multiple disciplines (see also Hermans et al. 2006); and ii) that
128 existing interdisciplinary studies that argue for the need to take values into account for better water
129 governance (e.g. van Schie et al. 2011) have paid limited attention to clearly distinguishing value types.
130 For example, some authors may treat diverse values such as 'equity' or 'economic water values' as if

131 they belonged into one single category of ‘values’, despite considerable differences in scope and
 132 nature of these values, which could be taken into account by distinguishing between fundamental,
 133 governance-related, and assigned values (Schulz et al. 2017a).

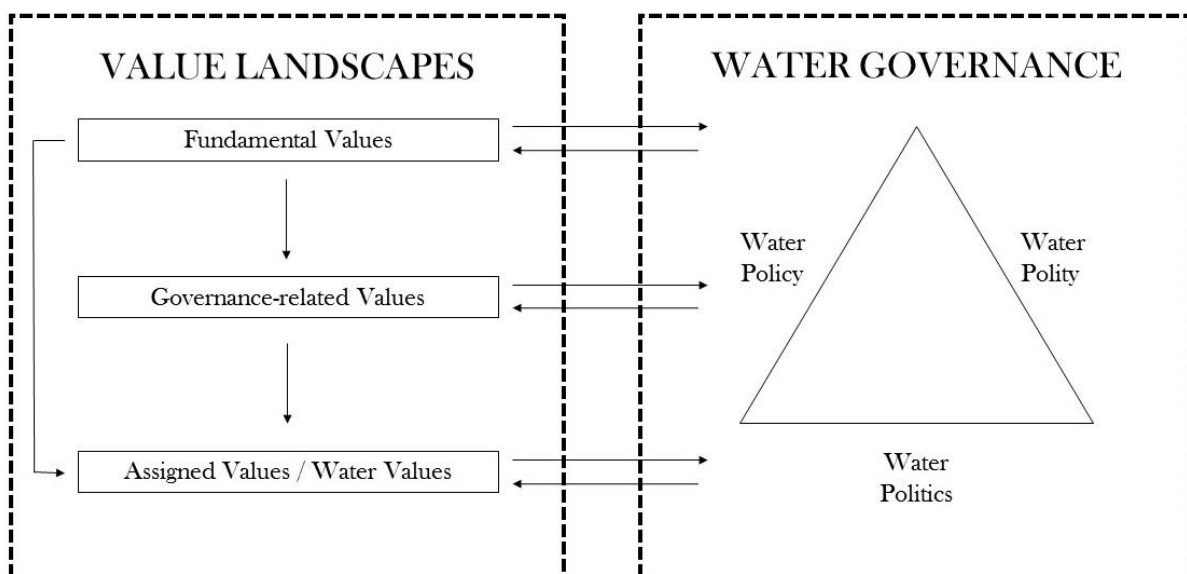


Figure 1: Schematic overview of the Value Landscapes Approach (adapted from Schulz et al. 2017a); arrows represent theoretically expected relationships of influence between variables

134 The Value Landscapes Approach brings together these three types of values (fundamental,
 135 governance-related, and assigned values), as well as their interrelationships and impacts on water
 136 governance and vice versa (see Figure 1). Arrows in Figure 1 represent theoretically-expected
 137 influence of some kind, i.e. the universally relevant fundamental values are expected to influence the
 138 more concrete governance-related values and assigned values / water values of people, but not vice
 139 versa (see also Brown 1984; Glenk & Fischer 2010; Seymour et al. 2010). For example, people who
 140 prioritise ‘universalism’ as a fundamental value may also favour ‘social justice’ as a governance-related
 141 value and ‘ecological values of water’ as an assigned value, but we would not normally assume that a
 142 preference for ecological water values is the more general cause of prioritising fundamental values;
 143 and the concrete context of water governance in a given place and time may also impact on people’s
 144 values, as experimental evidence shows that interacting within market institutions may erode moral
 145 values, for example (Falk & Szech 2013). Similarly, one could expect an increased concern for the
 146 governance-related value of ‘social justice’ in a situation where a concrete water governance project
 147 would have strong negative impacts on vulnerable minorities. Here, our focus lies on the impact of
 148 values on water policy preferences, however.

149 The definition of water governance is inspired by Treib et al.’s (2007) more general definition of
 150 governance as the combination of i) water polity (the institutional framework); ii) water politics
 151 (power relations between political actors); and iii) water policy (the mechanisms and instruments used
 152 to achieve certain outcomes). While the Value Landscapes Approach covers all three elements of
 153 water governance from a theoretical point of view, the present case study will focus on water policy,
 154 which we found most suitable for application within a survey with members of the general public.

155 Based on insights from various disciplines, but especially ecological economics, the Value Landscapes
 156 Approach i) assumes a strong interconnectedness between water governance and values; ii) analyses
 157 values at different levels of abstraction, with influence from more abstract to more concrete values;
 158 iii) is based on the idea of value pluralism as an empirical reality that can be studied (Schulz et al.

159 2017a), i.e., it does not seek to translate values into one ultimate category (Martinez-Alier et al. 1998).
160 Moreover, two broad hypotheses follow from this conceptual framework: i) if we know people's
161 values in a given time and location, this may help to understand their preferences and behaviour in
162 water governance; and ii) if we compare values expressed by actual water governance (e.g. a specific
163 water policy with an implicit value content) with values held by members of the general public
164 (especially governance-related and assigned values), we can assess the political legitimacy of existing
165 water governance in a given time and location (Schulz et al. 2017b). While the Value Landscapes
166 Approach was developed in the context of water governance, it could conceivably be adapted for the
167 analysis of other fields of environmental governance more generally.

168 The Value Landscapes Approach shares some features with other existing conceptual frameworks.
169 While a full discussion of commonalities and differences would be beyond the scope of the present
170 paper, it should be noted that the Value Landscapes Approach's emphasis on identifying values at
171 different levels of abstraction has similarities with the Cognitive Hierarchy Model (Fulton et al. 1996;
172 Homer & Kahle 1988; Vaske & Donnelly 1999), Values-Beliefs-Norms Theory (Dietz 2016; Stern et al.
173 1999), as well as the Advocacy Coalition Framework (Sabatier 1988; Sabatier & Weible 2007), which
174 are all based on the analysis of a number of constructs at varying levels of abstraction that are to some
175 degree causally related.

176 As opposed to the social psychological Cognitive Hierarchy Model and Values-Beliefs-Norms Theory,
177 the Value Landscapes Approach has an explicit interdisciplinary focus that aims to integrate various
178 value concepts from environmental and social psychology and beyond, given the centrality of the
179 concept of value in disciplines such as ecological and environmental economics, human geography,
180 and many others (see details below). Furthermore, it does not aim to represent an exhaustive model
181 of human behaviour which is common to social psychological frameworks, but rather 'zooms in' on
182 the concept(s) of values, and their relationship with governance.

183 Unlike the Advocacy Coalition Framework, the Value Landscapes Approach aims to understand
184 interlinkages between values and governance as they exist in people's minds in general, beyond those
185 specific actors that might have the opportunity to directly influence policy in their field (as part of an
186 'advocacy coalition'). In line with Henry and Dietz (2012: 251), it should be noted that despite their
187 common focus on environmental cognition, the various conceptual frameworks listed here should be
188 seen as complementary rather than competing, given that they aim to explain "different phenomena
189 in different contexts".

190

191 *2.1 Fundamental values*

192 The concept of fundamental values has its origin in social psychological theory; these values are
193 generally defined as abstract goals and principles that guide people's decision-making across
194 situations (Dietz 2016; Fulton et al. 1996; Rokeach 1973; Schwartz 1992; Schwartz et al. 2012; Steg &
195 de Groot 2012; Steg 2016). The label 'fundamental values' is taken from Fulton et al. (1996), but
196 numerous alternative terms exist that roughly fit the same definition, such as 'basic individual values'
197 (Schwartz et al. 2012), 'terminal values' (Rokeach 1973), or 'transcendental values' (Raymond &
198 Kenter 2016).

199 One of the most popular theoretical frameworks for fundamental values is Schwartz' theory of basic
200 individual values (Schwartz 1992; Schwartz et al. 2012), which in turn was inspired by earlier work of
201 Rokeach (1973; Schwartz & Bilsky 1987). In its original form, Schwartz (1992, 1994) proposed the
202 existence of ten basic values that are universally recognised among humans across cultures, only

203 varying in the relative importance given to them by different people across different situations. These
204 values are particularly salient in situations of value conflict, i.e. decision-making situations where two
205 alternative choices would reinforce different or opposing values (Schwartz 1992, 1994).

206 The ten fundamental values are universalism, benevolence, conformity, tradition, security,
207 achievement, power, hedonism, stimulation, and self-determination, arranged in a circular structure
208 that can be subsumed under two broad pairs of opposing higher-order dimensions (self-enhancement
209 vs. self-transcendence and openness to change vs. conservation), which broadly translate into concern
210 about oneself vs. concern for others, and a preference for novelty and innovation vs. preference for
211 keeping the status quo via order, self-restraint and traditions (Schwartz 1992, 1994).

212 While Schwartz and Boehnke (2004) note that these higher-order dimensions are but one of many
213 possibilities to classify the ten basic values, a large number of empirical studies have found that self-
214 transcendence values tend to be positively correlated with pro-environmental behaviour, norms, and
215 attitudes, whereas self-enhancement values tend to be negatively correlated (Evans et al. 2013;
216 Kilbourne et al. 2005; Schultz et al. 2005; Steg & de Groot 2012). Considerably less consistent empirical
217 evidence has been found for a relationship between pro-environmental behaviour and the dimensions
218 of openness to change vs. conservation (but see Poortinga et al. 2004), although from a theoretical
219 point of view one can easily construct such hypotheses, e.g. assuming that political conservatism goes
220 along with reduced concern for the environment (Dietz 2016).

221 In the applied field of environmental psychology, the subset of fundamental values that are strongly
222 correlated with environmental concern and pro-environmental behaviour in modified versions of the
223 Schwartz value theory (1992, 1994), such as biospheric or altruistic values (i.e. of caring about the
224 environment for its own sake as well as for improved human welfare) (Steg, Perlaviciute et al. 2014;
225 Stern et al. 1998) are often referred to as 'environmental values' (Dietz 2016; Steg & de Groot 2012).
226 Thus, in environmental psychology, 'environmental values' typically stands for (personally held)
227 'values and abstract goals that inform pro-environmental behaviour, norms, and attitudes'.

228 However, it is important to note that the same term can also mean 'values of the environment', i.e.
229 assigned values (see section 2.3), which is a typical use in disciplines such as ecological economics or
230 human geography, or where environmental valuation is concerned (Arias-Arévalo et al. 2017; Norton
231 & Steinemann 2001; Seymour et al. 2011; Spash & Vatn 2006; Tadaki et al. 2017). This polysemy (i.e.
232 multiple related meanings of the same words) may cause some confusion, which we avoid here by
233 using the conceptual framework proposed by Schulz et al. (2017a). Analogous to biospheric and
234 altruistic values as elements of the self-transcendence dimension, a number of individual fundamental
235 values have been identified in the literature that tend to correlate negatively with pro-environmental
236 behaviour, norms, and attitudes. These are egoistic and hedonic values (i.e. a concern about one's
237 personal resources; or for improving one's feelings and reducing effort), which fall into the broader
238 dimension of self-enhancement (Steg, Bolderdijk et al. 2014; Steg & de Groot 2012), although hedonic
239 values are also sometimes categorised as pertaining to the openness to change dimension (Dietz 2016;
240 Schwartz 1992, 1994).

241 From the perspective of the practitioner in environmental management, research in environmental
242 psychology suggests that better knowledge of environmental values can contribute to better design
243 of incentives for pro-environmental behaviour (Crompton et al. 2010), including environmental policy.
244 For example, the recently proposed 'Integrated Framework for Encouraging Pro-environmental
245 behaviour' (IFEFP) outlines multiple pathways for encouraging pro-environmental behaviour, such as
246 the activation of biospheric values via situational cues or the reduction of perceived costs associated
247 with such behaviour (Steg, Bolderdijk et al. 2014). Given the relatively stable nature of fundamental

248 values across an individual's lifetime (and across generations), their activation via situational cues (e.g.
249 in the context of marketing or information campaigns) seems indeed a much more viable strategy
250 than simply aiming to 'change' values in general.

251 Value change involves timescales of generations and is thus difficult to control (Manfredo et al. 2017a,
252 2017b), although Ives and Fischer (2017) suggest that short-term value change is sometimes possible,
253 and that, even if difficult and slow, intentional value change should remain an important priority e.g.
254 for conservationists. Also, it is important to remember that people may hold multiple and competing
255 values that may contradict each other (Schwartz 1992, 1994). Yet, 'value activation' strategies will be
256 more successful with individuals who hold stronger pro-environmental values than others in the first
257 place (Steg, Bolderdijk et al. 2014; Steg & de Groot 2012). In any case, all cited studies emphasise the
258 real-world relevance of research on people's (environmental) values in the context of concrete
259 decision-making situations, as well as their relevance for understanding environmental cognition more
260 broadly (Dietz 2016; Steg 2016).

261

262 *2.2 Governance-related values*

263 In the Value Landscapes Approach, governance-related values are defined as idealised characteristics
264 or properties of water governance that are expressed as desirable by individuals and groups (Schulz
265 et al. 2017a). The concept is less established as a distinct analytical category than fundamental values
266 (Schulz 2018), although governance-related values themselves, such as equity or sustainability, have
267 been the subject of philosophical and normative debates for centuries (see e.g. Du Pisani 2006; Young
268 1994). They also frequently appear in the general public administration literature, where a separate
269 body of research on the topic is consolidating (Beck Jørgensen & Bozeman 2007; de Graaf et al. 2016;
270 Rutgers 2015; Tsanga Tabi & Verdon 2015).

271 Applied to the field of water governance, studies often evaluate the degree of various governance-
272 related values such as sustainability (e.g. Antunes et al. 2009; Iribarnegaray & Seghezzeo 2012; Kuzdas
273 et al. 2014; Milman & Short 2008), legitimacy, efficiency and effectiveness (e.g. Lieberherr et al. 2012;
274 Moss & Newig 2010; van Meerkerk et al. 2015) or social justice (e.g. Lukasiewicz et al. 2013; Patrick
275 2014; Perreault 2014) associated with different governance options. Many of these studies develop
276 sophisticated systems of indicators aimed at measuring and evaluating the level of realisation of such
277 governance-related values in practice (see e.g. van Leeuwen et al. 2012 for a list of 24 indicators
278 measuring the sustainability of urban water governance). In their level of detail, these indicator
279 systems go far beyond the general definition of each respective value, e.g. of sustainability as the
280 possibility for a process to continue within long, potentially indefinite time-scales (Johnston et al. 2007)
281 or the notion of safeguarding natural resources for future generations (Daly 1990). Yet by looking at
282 individual values only, they fail to consider inevitable trade-offs and/or conflicts between various
283 governance-related values (de Graaf et al. 2016; Grotenbreg & Altamirano 2017), such as between
284 social justice and economic efficiency. Nevertheless, the existence of such a large body of literature
285 on individual governance-related values points to high levels of interest in this specific category, and
286 provides additional justification for the inclusion of this type of values into the conceptual framework
287 underpinning our empirical analysis.

288 Governance-related values may thus serve as abstract guiding principles in decision-making in water
289 governance, or represent properties of water governance that may or may not have been realised yet.
290 They are different from fundamental values as they are located at the intersection of internal, abstract
291 goals, and external values assigned to elements of governance (such as a concrete policy), taking a

292 middle position between fundamental and assigned values in the Value Landscapes Approach (Schulz
293 et al. 2017a). Sustainability or social justice are both abstract goals as well as properties assigned to
294 elements of governance.

295 Holders of governance-related values are not only actors and stakeholders within water governance,
296 but also members of the general public (Glenk & Fischer 2010; Schulz et al. 2017a; Schulz 2018).
297 Despite numerous case studies on individual values as cited above, and a number of conceptual
298 overview papers on natural resource governance principles (Akhmouch & Correia 2016; Kooiman &
299 Jentoft 2009; Lockwood et al. 2010; Moreno Pires et al. 2017; Mostert 2015), Glenk and Fischer (2010)
300 note a lack of quantitative research on governance-related values, especially in the environmental
301 economics and psychology literatures. In the absence of an established comprehensive governance-
302 related values theory and associated measurement instruments, it is thus left to individual researchers
303 to define their own set of governance-related values to be studied on a case-by-case basis (Schulz
304 2018).

305

306 *2.3 Assigned values / water values*

307 The concept of assigned values refers to the concrete values that people attach to the environment,
308 environmental resources, landscapes and places (Brown 1984; Chan et al. 2012; Ives & Kendal 2014;
309 Lockwood 1999; Schulz et al. 2017a; Seymour et al. 2010). As such, this category of values is the most
310 prevalent type in the environmental valuation literature, although terminologies may vary widely,
311 with the most common conceptualization currently used being the ecosystem services framework
312 (Grizzetti et al. 2016; Hackbart et al. 2017; Martin-Ortega et al. 2015; Small et al. 2017). Here we prefer
313 to use the more open-ended term ‘assigned values’ as opposed to the more prescriptive term
314 ‘ecosystem services’, which is associated with a particular normative vision of environmental
315 management and human-nature relationships (Schröter et al. 2014) that may not necessarily match
316 with the normative vision that the average person subscribes to (Braitto et al. 2017).

317 The term ‘water values’ simply stands for assigned values of water resources. It may refer to their
318 value for irrigation, human consumption, bathing, navigation, or their role in sustaining ecosystems,
319 as well as to more intangible values such as cultural, aesthetic and spiritual values. It is used as a short-
320 hand reference for such assigned values in a significant part of the literature, especially in human
321 geography and related areas (see e.g. Barber & Jackson 2011; Bark et al. 2011; Berry et al. 2018; Euzen
322 & Morehouse 2011; Gibbs 2010; Ioris 2012), but also in environmental economics (e.g. Bjornlund &
323 O’Callaghan 2005; Saliba et al. 1987). Similar terms exist for other important environmental resources,
324 e.g. ‘forest values’ (Bengston 1994; Brown 2013; Brown & Reed 2000; Manning et al. 1999; McIntyre
325 et al. 2008). Assigned values have been measured using a wide range of methods from focus group
326 research to survey approaches, but due to their variability and context-specific nature (which is
327 typically emphasised by human geographers, e.g. Gibbs 2010; Ioris 2012), their classification and
328 measurement is usually customised to fit the specific research context at hand (Ives & Kendal 2014;
329 Seymour et al. 2010).

330 Lockwood (1999) noted that assigned values are conceptually close to environmental attitudes (i.e.
331 psychological tendencies to favour or disfavour certain attitude objects) in the environmental
332 psychology literature, e.g. where attitudes towards specific ‘environmental objects’ such as hazardous
333 waste dumps are concerned (Stern et al. 1995), not least because both assigned values and
334 environmental attitudes are comparatively more concrete than fundamental values (i.e. abstract
335 transsituational goals), and relate to external objects (Lockwood 1999). Nevertheless, here we follow

336 Dietz et al. (2005) who suggest that attitudes are far more specific than values, giving the example of
337 the (assigned) value of ‘wilderness’, and the attitude of ‘opposing oil development in a wildlife refuge’.
338 We also prefer the terminology of ‘values’ to that of ‘attitudes’, given that values are generally seen
339 as more stable than attitudes, which in turn may change more easily (Dietz et al. 2005; Homer & Kahle
340 1988; Shin et al. 2017).

341 Another related concept are ‘beliefs’, which have been defined as “facts as an individual perceives
342 them” (Dietz et al. 2005: 346). Yet, as Schwartz (1992) notes, all (fundamental) values are also beliefs;
343 and in the same way, all assigned values are also beliefs about the particular qualitative importance
344 of an environmental resource (e.g. ‘water resources are a source of fish’, or of cultural value), which
345 typically go along with a quantitative assessment of the resource’s relative importance in comparison
346 with other assigned values (e.g. ‘the ecological value of water is more important than its aesthetic
347 value’) (Bengston 1994; Ives & Kendal 2014; McIntyre et al. 2008; Seymour et al. 2010). While all
348 assigned values are beliefs, not all beliefs are assigned values, so we prefer to use the term ‘assigned
349 value’ throughout our analysis, which is more parsimonious and can avoid confusion with beliefs
350 beyond the realm of values. This is not to say that we oppose the simultaneous investigation of values
351 and beliefs-beyond-values, which is established practice e.g. in values-beliefs-norms theory (Dietz
352 2016; Stern et al. 1999).

353

354 **3 Applying the Value Landscapes Approach to the conflict over the Paraguay-Paraná Waterway,** 355 **Mato Grosso, Brazil**

356 In this article, we apply the Value Landscapes Approach to the case study of a conflict over the
357 construction of the Paraguay-Paraná Waterway (*Hidrovia Paraguai-Paraná*) in the state of Mato
358 Grosso, Brazil. This is a typical environmental conservation vs. economic development conflict. The
359 waterway is part of a strategic national plan for Brazil’s inland navigation infrastructure and has the
360 objective of facilitating year-round aquatic transport and the export of agricultural products such as
361 soybeans and cotton from Mato Grosso to world markets (ANTAQ 2013). This would reduce transport
362 costs significantly, and likely further fuel the expansion of soybean production in Mato Grosso
363 (Fearnside 2001), already Brazil’s leading producer (Arvor et al. 2018; Ioris 2016), with strong trade
364 links to China (Lathuillière et al. 2014; Peine 2013). While the full waterway extends over 3442 km
365 from Cáceres, Mato Grosso, Brazil, to the port of Nueva Palmira in Uruguay, crossing Paraguayan and
366 Argentinean territory further downstream, the main controversy concerns the upriver segment on the
367 Paraguay River in Mato Grosso, near Cáceres, which would run across the Pantanal wetland (da Silva
368 et al. 2004; Figueiredo et al. 2012; Leão et al. 2013; Schulz et al. 2017b).

369 The Pantanal is often considered a global natural heritage, recognised e.g. by UNESCO or the Ramsar
370 Convention, due to its status as an important refuge for endangered biodiversity (Calheiros et al. 2012;
371 Ioris 2013; Junk et al. 2006). Implementing the waterway there would require major engineering works,
372 such as dredging of shallow sections, removal of rocks, and straightening of curves (Hamilton 1999),
373 which would impact on the hydrology and ecology of the Pantanal, including its characteristic ‘flood
374 pulse’, with associated repercussions for local biodiversity, flood protection downstream, as well as
375 local people’s livelihoods (da Silva et al. 2004; Gottgens et al. 2001; Junk et al. 2006). As of 2016, the
376 project has passed a technical, economic, and environmental impact assessment (UFPR/ITTI 2016),
377 but construction has not yet started, likely due to Brazil’s ongoing political and economic crisis. It is
378 chiefly supported by the state government of Mato Grosso and the local agribusiness sector, and
379 opposed by many environmentalists and fishermen who are concerned about impacts on biodiversity
380 and fish stocks (Schulz et al. 2017b).

381 In a previous study, which laid the foundation for the present study, Schulz et al. (2017b) investigated
382 the controversy over the Paraguay-Paraná Waterway using qualitative research techniques and
383 focussing exclusively on professionals from water-related sectors in the state of Mato Grosso, rather
384 than members of the general public, as is done here. A comparison of the values expressed by
385 supporters of the waterway in the interviews with the values of those opposed suggested that among
386 relevant stakeholders, support or opposition to the project went along with two very different value
387 landscapes.

388 One value landscape consisted of a cluster of governance-related values such as efficiency,
389 pragmatism, and order (in the sense of legal certainty, security, and the ability to plan more generally),
390 which relate well to a general vision of Mato Grosso as a place of strong economic development and
391 growth. These governance-related values were complemented with assigned values such as
392 navigation, agriculture, tourism, and aquaculture, i.e. mostly economic water values. Values of this
393 first value landscape were typically expressed by supporters of the waterway, especially
394 representatives of the agribusiness sector. A second value landscape emerged with an alternative
395 focus on governance-related values such as equity, social justice, conservation/tradition and solidarity,
396 and assigned values mostly related to culture, such as subsistence fishing, traditional festivities along
397 the rivers, aesthetic values, as well as ecological values of water. This value landscape was closely
398 associated with opposition to the waterway and typically found among traditional fishermen in the
399 Pantanal, as well as NGO activists and academics opposed to the project (Schulz et al. 2017b).

400 Thus, in line with the Value Landscapes Approach and the previous qualitative work of Schulz et al.
401 (2017a, 2017b), we specifically aim to test the following two broad hypotheses:

402 *H1: We can identify people's value landscapes operationalised as statistically identifiable relationships*
403 *among the three different types of values (fundamental values, governance-related values, and*
404 *assigned values), with fundamental values being the most abstract construct 'predicting' both*
405 *governance-related values and assigned values.*

406 The present study thus serves to test whether the hypothetical relations of influence outlined in the
407 Value Landscapes Approach (visualised by the arrows on the left side of Figure 1) can indeed be
408 identified empirically. Here the various types of values are operationalised via survey statements, with
409 survey results then feeding into the design of a structural equation model (see sections 4 and 5 below).
410 If such a structural equation model cannot be rejected, this could be seen as a form of empirical
411 evidence and validation of the many different conceptual considerations that fed into the
412 development of the Value Landscapes Approach. While a 'cascade' from more abstract concepts
413 influencing more concrete concepts that people subscribe to is the basis of many theoretical
414 frameworks (see e.g. Brown 1984; Glenk & Fischer 2010; Homer & Kahle 1988; Lockwood 1999;
415 Seymour et al. 2010; Stern et al. 1999), no previous empirical evidence exists of the interrelatedness
416 of fundamental, governance-related, and assigned values simultaneously. One study has investigated
417 the link between fundamental and governance-related values (Glenk & Fischer 2010), while there is
418 some limited evidence of systematic links between fundamental values and assigned values (e.g. Hicks
419 et al. 2015; van Riper & Kyle 2014), but not between all three value types at once.

420 Hicks et al. (2015) suggested that assigned values (referred to as ecosystem services in their study)
421 can be directly associated with certain fundamental value domains (e.g. a preference for fish as an
422 assigned value/provisioning service of a marine ecosystem is an expression of the fundamental value
423 dimension of self-enhancement), which is in line with our conceptual framework; however, the study
424 relied on the researchers to 'match' assigned values with corresponding fundamental values based on
425 qualitative interview transcripts, whereas our study is using more established psychometric

426 measurement instruments to elicit fundamental values (although admittedly such statistical
427 approaches are less suited to detect individual outliers), and the links with further value categories
428 are based on statistical evidence, rather than manual coding.

429 Van Riper and Kyle (2014), in turn, compared how people holding strong pro-environmental
430 fundamental values identified various assigned values in a specific geographical area as opposed to
431 more neutral research participants, using Public Participation Geographical Information System (PPGIS)
432 methods (Sieber 2006) and a Social Values for Ecosystem Services (SoVES) mapping application
433 (Sherrouse et al. 2011). The study demonstrated that those with stronger pro-environmental
434 fundamental values gave much higher importance to various assigned values related to
435 environmentalism, such as the assigned value of biodiversity, visualised in strikingly different maps of
436 assigned values generated by pro-environmentalists' and a more neutral group's answers. These
437 findings are in line with our conceptual framework, but again, our method of analysis is different. Also,
438 neither van Riper and Kyle (2014) nor Hicks et al. (2015) considered governance-related values as a
439 separate category of relevance to water governance / environmental governance more generally.

440 *H2: There is a measurable impact of people's value landscapes on their water policy preferences.*

441 Beyond understanding interrelations between values, we also aim to test the hypothesis that people's
442 values influence their preferences in water governance (in this case, their water policy preferences),
443 which follows from the various conceptual considerations on which the Value Landscapes Approach
444 is based (as visualised by the arrows linking value landscapes and water governance in the middle of
445 Figure 1).

446 This is a relevant hypothesis for multiple reasons; it enhances the real-world relevance of values
447 research, given the applied nature of water governance, and further validates the idea that values are
448 deeply embedded and connected to society and culture in multiple ways (Manfredo et al. 2017a),
449 including in water governance (Groenfeldt 2013); it would demonstrate that values matter for water
450 policy preferences, as opposed to other variables such as interests, which are defined as needs or
451 desires for resources such as time, space, money or natural resources (Kouzakova et al. 2012), which
452 one could expect to have played a larger role e.g. for the stakeholders interviewed by Schulz et al.
453 (2017b). This is especially significant considering that conflicts about values (as opposed to mere
454 material interests) are more likely to turn emotional or escalate (Kouzakova et al. 2012), which makes
455 them much more difficult to resolve (Harinck & Druckman 2017; Illes et al. 2014).

456 Furthermore, measuring the impact of people's value landscapes on their water policy preferences
457 with statistical methods and survey data from members of the general public as opposed to
458 stakeholders is also important given that people may express different values in their capacity as group
459 representatives (e.g. of a certain institution), as opposed to when consulted as private citizens (Cramer
460 et al. 1993; Manfredo et al. 2017a).

461

462 **4 Methodological approach**

463 *4.1 Structural equation modelling*

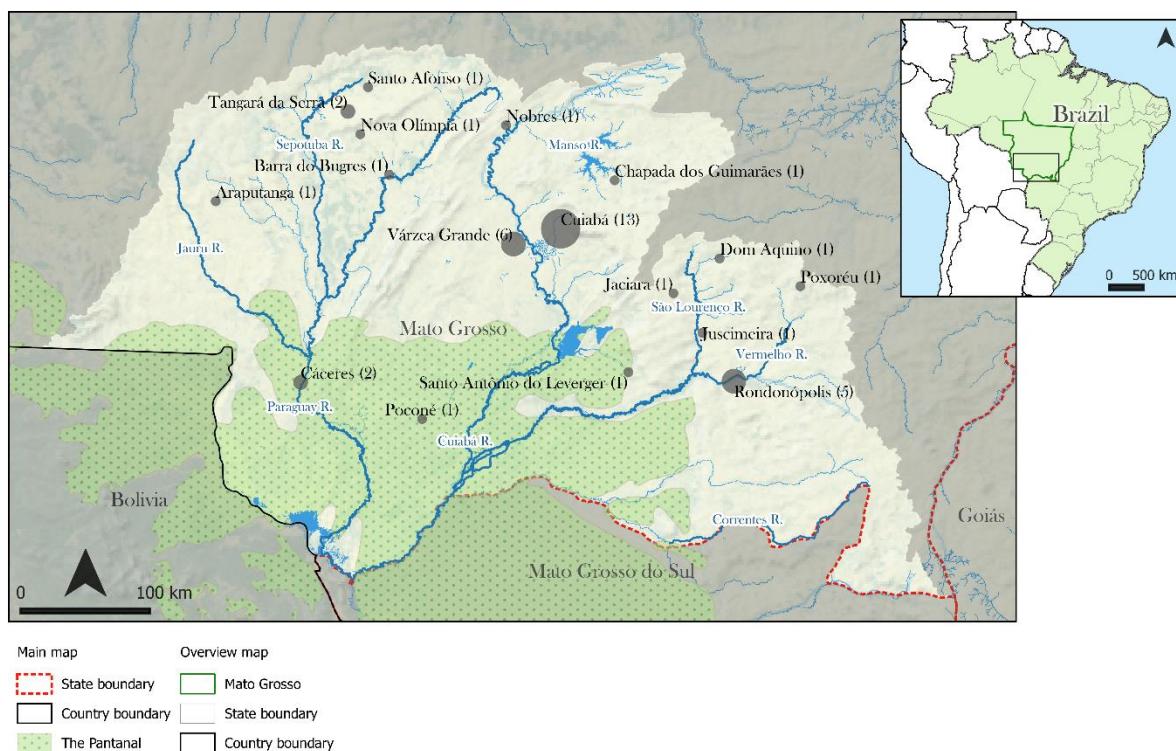
464 Structural equation modelling (SEM) is a statistical technique that allows empirical testing of complex
465 theoretical relationships between multiple variables, including latent variables such as people's values.
466 Specifically, SEM studies typically combine path analysis (to test hypothesised causal structures
467 between variables) and confirmatory factor analysis (to measure latent variables using several
468 observed indicators) (Garson 2015; Kline 2011). As mentioned earlier, it is an established tool for the

469 statistical analysis of underlying motivations for people’s preferences and behaviour (e.g. Glenk &
 470 Fischer 2010; Pradhananga et al. 2017; Toma et al. 2011; Yazdanpanah et al. 2014) and thus very
 471 suitable for the analysis of value landscapes and their impact on water policy preferences.

472

473 **4.2 The sample**

474 Our structural equation model relies on survey data collected among members of the general public
 475 (n=1067) in the Upper Paraguay River Basin in Mato Grosso between April and June 2016 with the
 476 help of trained local interviewers. The Paraguay-Paraná Waterway would be constructed in this
 477 hydrographic area, which also encompasses large parts of the Pantanal wetland as well as major
 478 population centres of Mato Grosso, such as the state capital Cuiabá (see Figure 2). The exact
 479 boundaries of the river basin were identified using a map from the Brazilian National Water Agency
 480 (ANA 2006).



481

482 *Figure 2: Sampled census tracts in the Upper Paraguay River Basin, Mato Grosso; numbers indicate the number of sampled*
 483 *census tracts per municipality (source of city locations, rivers, waterbodies: © OpenStreetMap contributors) USE COLOUR*
 484 *ONLINE ONLY*

485 Sampling occurred during two stages. First, 40 census tracts (i.e. small geographical units created by
 486 the Brazilian Institute for Geography and Statistics, IBGE, to facilitate household sampling) within the
 487 Upper Paraguay River Basin were randomly sampled with probability proportionate to size sampling
 488 as outlined in Turner (2003), then 30 households within each census tract, using sample frames and
 489 address lists from IBGE (IBGE 2011a, 2011b, 2011c) were sampled (see supplementary material S1 for
 490 the list of sampled census tracts). Generally at least two attempts were made to interview a member
 491 of a specific household that was randomly sampled from address lists. In case of repeated non-
 492 response, replacement rules were in place which defined how to randomly select an alternative
 493 household from the respective address list. Within-household selection of respondents was
 494 determined by the household, limited to adults, as is often done in survey research (Gaziano 2005).

495 The overall response rate (completed interviews at targeted households divided by number of
496 households approached) was 43.77%, the size of the working sample for subsequent analysis was
497 N=1028 for the full structural equation model (N=1055 (governance-related values) and N=1057
498 (assigned values) for the confirmatory factor analyses reported in the supplementary material). In case
499 of missing data, cases were deleted listwise, which affected no more than 3.94% of overall
500 observations at any point. This is below the 5% threshold that Garson (2015) recommends for using
501 listwise deletion.

502 To assess the representativeness of our sample, socio-demographic characteristics of respondents
503 were compared with data from the 2010 IBGE census (see Table 3/Appendix A and supplementary
504 material S2). Our sample approximates representativeness as only the difference in proportions for
505 the variable 'occupational status' is statistically significant, likely in part due to increased
506 unemployment levels in 2016 as a result of economic recession in Brazil.

507

508 *4.3 Questionnaire design*

509 The questionnaire used in our survey consisted of five sections that were analysed for the present
510 study (socio-demographics; fundamental values; governance-related values; assigned values; water
511 policy preferences regarding the Paraguay-Paraná Waterway). To measure a respondent's
512 fundamental values, we used Schwartz' universal value framework, and specifically, the Portrait Value
513 Questionnaire (PVQ) with 21 items introduced by Schwartz (2001). It has been translated into
514 Portuguese for the European Social Science Survey and was developed precisely to allow easy
515 application to any type of respondent irrespective of age, cultural, or educational background.
516 Furthermore, it has been tested in numerous studies around the globe, including in Brazil (Tamayo &
517 Porto 2009). Another advantage of using the PVQ instead of alternative measurement instruments for
518 fundamental values typically used e.g. in environmental psychology studies is its broad applicability
519 beyond purely environmental topics. While the measurement instruments developed e.g. by Steg,
520 Perlaviciute et al. (2014) or Stern et al. (1998) were explicitly developed to measure values that might
521 influence a person's attitudes towards the environment and pro-environmental behaviour, these
522 instruments do not have any obvious connection with governance and governance-related values.
523 This is why we selected Schwartz' PVQ (Schwartz 2001), which measures very broad personal values
524 that would be equally relevant to both governance-related values as well as specific environmental
525 issues and values. The exact list of the 21 survey items of the PVQ that we used in our study can be
526 found in Schwartz (2001: 284-286).

527 With regards to governance-related values and assigned values, no existing measurement instruments
528 were readily available. For the case of governance-related values we were not aware of any
529 instrument that would have been widely tested and developed (Schulz 2018), whereas assigned values
530 are too context-specific to be elicited with a standardised measurement instrument (Ives & Kendal
531 2014; Seymour et al. 2010). Thus we relied on the list of values identified by Schulz et al. (2017b) (and
532 Schulz & Ioris 2017) in an exploratory study with local stakeholders to design our survey items,
533 assuming that these would be appropriate in the local context (see Tables 1 and 2). For both
534 governance-related values and assigned values, respondents first picked their 'most important item',
535 and were then asked to rate the relative importance of remaining items on a scale from 1 to 5, with 5
536 indicating equal importance, and 1 indicating no importance. This combination of a qualitative value
537 description with a relative rating exercise is in line with the definition of assigned values presented
538 earlier, which combines qualitative and quantitative aspects (Brown 1984; Ives & Kendal 2014;

539 McIntyre et al. 2008) (see supplementary material S3 where the exact question stems for assigned
540 values and governance-related values are listed).

541 The items were classified into three factors (i.e. latent variables) each, using exploratory factor analysis
542 (EFA), although one factor within governance-related values was later excluded from the analysis (see
543 supplementary material S4). Respondents were also asked whether they would support or oppose the
544 waterway if a hypothetical referendum was held about its construction. This question was preceded
545 by a brief description of the controversy that aimed to be as neutral and balanced as possible, citing
546 advantages and disadvantages that have been mentioned in the media, academic literature, and in
547 stakeholder interviews (Schulz et al. 2017b) (see supplementary material S5 for the full description of
548 the advantages and disadvantages of the Paraguay-Paraná Waterway that survey respondents were
549 given).

550 *Table 1: Assigned values (i.e. water values): List of items*

Cultural water values	Traditional lifestyles, for example artisanal fishing or use of clay for ceramics, depend on rivers. Mato Grosso’s culture has a strong relationship with the rivers and waterbodies, for example during traditional festivities.
Economic water values	The state’s economy depends on water abundance, especially for agriculture and cattle ranching. The rivers produce almost all electric energy that is used in Mato Grosso.
Ecological water values	The rivers sustain the nature of the Pantanal wetland. The rivers and waterbodies are important for the survival of wildlife, for example jaguars, birds, caimans etc.

551

552 *Table 2: Governance-related values: List of items*

Democratic governance-related values (democratic legitimacy and social justice)	Follow the opinion of the majority of the population. Care about the poor and minorities.
Economic governance-related values (economic efficiency and rule of law/order)	Not to waste public money. Everyone follows the law.

553

554 **5 Results and discussion**

555 *5.1 Support and opposition to the construction of the Paraguay-Paraná Waterway*

556 Overall, 64.4% of respondents were opposed to the waterway and 33.6% were in favour (while 0.3%
557 refused to answer and 1.7% didn’t know), which is in itself an interesting result with clear policy
558 relevance. To ascertain that this result was not driven by a potential implicit bias among interviewers
559 or the description of the project, we also asked respondents, beforehand, whether they already knew
560 about the project (64.8% didn’t, 35.2% did). Among those respondents who stated to know about the
561 project, 60.1% opposed it and 39.9% favoured it, which is close to the overall ratio of approval.
562 Assuming that those respondents who knew about the project had already formed an opinion, this
563 suggests that no obvious bias was induced through interviewers or the information provided.

564

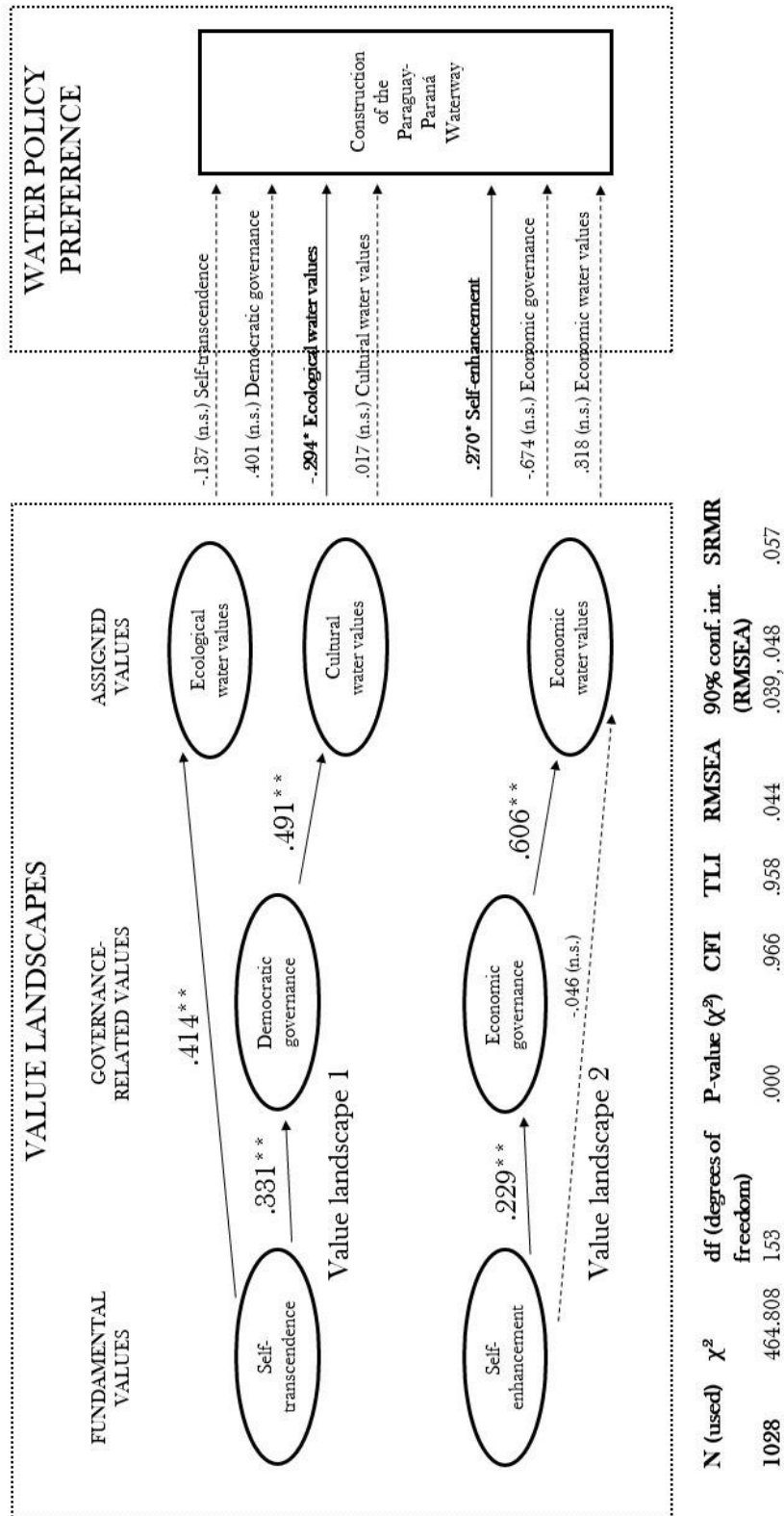
565 *5.2 A structural equation model of value landscapes and their impact on water policy preferences*

566 The 'final' empirical output of the present paper is a structural equation model of our respondents'
567 value landscapes and their impact on respondents' water policy preferences, in this case in favour or
568 against the construction of the Paraguay-Paraná Waterway in the Pantanal wetland of Mato Grosso,
569 Brazil (visualised in Figure 3; full model parameters in Table 4/Appendix B). Due to limitations of space,
570 we cannot outline the entire model development process here, which consisted of exploratory factor
571 analyses (EFAs) for governance-related values and assigned values, confirmatory factor analyses (CFAs)
572 for fundamental, governance-related, and assigned values (to validate the measurement model of our
573 structural equation model), as well as conceptual considerations informing the final structure or path
574 model of our structural equation model. Most details of EFAs and CFAs are instead presented in the
575 supplementary material (sections S5 and S6).

576 The structural equation model was estimated with the lavaan package within R (v. 0.5-23.1097)
577 (Rosseeel 2017). Having ordinal data, we used polychoric correlations for this analysis, which assumes
578 that an underlying continuous variable is measured in a number of discrete categories (Garson 2015);
579 a plausible assumption for people's values. Furthermore, we applied diagonally weighted least
580 squares (DWLS) as a model estimation method, which is appropriate for categorical and ordinal data
581 with sample sizes of around 1000 (Bandalos 2014). To evaluate model fit, we relied on a combination
582 of absolute and incremental fit indexes (RMSEA, SRMR, CFI, TLI, and model χ^2 significance) as is widely
583 recommended in the SEM literature (Garson 2015; Hu & Bentler 1999; Kline 2011). All indexes
584 indicated good fit (i.e. RMSEA<0.06; SRMR<0.08; CFI/TLI>0.95), except model χ^2 , which is sample-size
585 sensitive, and according to Garson (2015) may reject most models with a sample size above 200. All
586 factor loadings are 0.45 or higher, indicating that our measurement model is acceptable (Stevens
587 2009).

588 From a conceptual point of view, the model was based on the two main hypotheses developed in
589 section 3. That is, it was designed to apply the general framework of the Value Landscapes Approach
590 (see Figure 1, section 2) to the case of public preferences regarding the Paraguay-Paraná Waterway,
591 taking into account previous empirical research findings of the wider literature as well as of Schulz et
592 al. (2017b). Here we discuss our findings regarding each hypothesis and their respective components.
593 Based on ample previous evidence (Evans et al. 2013; Kilbourne et al. 2005; Schultz et al. 2005; Steg
594 & de Groot 2012), we assumed that self-transcendence and self-enhancement would be the main
595 divergent relevant dimensions at the level of fundamental values, informing people's views on
596 environmental issues. We then related these two main dimensions with the more concrete constructs
597 of governance-related values and assigned values, which indeed produced mostly statistically
598 significant links within each value landscape (see Figure 3). Given that Schulz et al. (2017b) had
599 identified two separate value landscapes among their interviewees, we designed our model here
600 accordingly, with no interlinkages between value landscape 1 (consisting of self-transcendence values,
601 democratic governance-related values, cultural and ecological water values) and value landscape 2
602 (self-enhancement values, economic governance-related values, economic water values).

603



604

605 Figure 3: A structural equation model; dashed paths indicate non-statistically significant relations; * indicates significance
 606 at .05 level, ** indicates significance at .01 level.

607

608

609 5.3 Value landscapes relationships (Hypothesis 1)

610 Findings with respect to Hypothesis 1 are split up into a number of components below, which all
611 correspond to individual arrows in our structural equation model (see Figure 3).

612 *Finding 1: Self-transcendence values relate positively with democratic governance-related values.*

613 We expected that self-transcendence would have a positive association with democratic governance-
614 related values, given that the survey items measuring this type of values (see Table 2) both emphasise
615 caring about other people and their views, which in turn relates well with the values of benevolence
616 and universalism in the Schwartz survey (Schwartz 1992, 1994, 2001). We did find such a positive link
617 that is statistically significant. This suggests that self-transcendence values are reflected in people's
618 preferences for governance-related values such as social justice and democratic legitimacy.

619 *Finding 2: Self-enhancement values relate positively with economic governance-related values.*

620 We expected the self-enhancement dimension to relate positively with economic governance-related
621 values, due to the emphasis of the related survey items (see Table 2) on efficiency and legality, which
622 could plausibly be associated with the fundamental value of achievement in the self-enhancement
623 dimension. We did find such a positive link that is statistically significant. This suggests that self-
624 enhancement values are reflected in people's preferences for governance-related values such as
625 economic efficiency and rule of law/order.

626 *Finding 3: Self-transcendence values relate positively with ecological water values.*

627 We expected that self-transcendence would relate positively with ecological water values, again in
628 line with previous literature on environmental values more generally (Schultz et al. 2005; Steg & de
629 Groot 2012), as well as specific literature on the link between fundamental values and assigned values,
630 as summarised in section 3 (Hicks et al. 2015; Van Riper & Kyle 2014). This assumption is indeed
631 confirmed by our data and model with statistically significant links.

632 *Finding 4: Democratic governance-related values relate positively with cultural water values.*

633 The status of cultural water values was less clear, but for the concrete case study context, we
634 hypothesised that democratic governance-related values would relate positively with cultural values,
635 given that in the Upper Paraguay River Basin, the conservation of water-related traditions, festivities,
636 and culture rests upon marginalised and poor riparian communities (Schulz et al. 2017b), which in turn
637 are the focus of the survey item for 'social justice', i.e. democratic governance-related values. We did
638 not relate it with either fundamental value dimension in our model, given that we would expect
639 cultural water values to be most closely related with Schwartz' (1992, 1994) conservation dimension
640 (i.e. traditional values), which is not part of our model here. This relationship is found, too. We would
641 be cautious to generalise this finding beyond the context of Mato Grosso, however, given that the link
642 between culture, traditions and marginalisation (which could be addressed by better social justice and
643 democratic legitimacy) is especially strong in this particular geographical area but might be less so in
644 other contexts.

645 *Finding 5: Self-enhancement values relate positively with economic water values.*

646 We expected self-enhancement to relate positively with economic water values. This would be in line
647 with previous findings of e.g. Kilbourne et al. (2005) who found that material values relate positively
648 with self-enhancement (and one could conceive of economic water values produced by agriculture
649 and hydroelectric power as material values). While this relationship does not appear as statistically
650 significant in the full structural equation model presented in Figure 3, we found that this is entirely

651 due to mediation effects, i.e. a situation where an independent variable has an effect on a dependent
652 variable through a third (mediating) variable (Baron & Kenny 1986; Zhao et al. 2010). It appears that
653 in our model that the effect of the independent variable self-enhancement on the dependent variable
654 economic water values is affected by the mediating variable economic governance-related values.
655 Evidence for that is that if we delete the mediating variable economic governance-related values from
656 the model, the relationship between self-enhancement and economic water values becomes
657 statistically significant (p-value of 0.021), with a coefficient of 0.119. This is in line with our assumption
658 that fundamental values may have an impact on both governance-related values and assigned values.

659 *Finding 6: Economic governance-related values relate positively with economic water values.*

660 The link between economic governance-related values and economic water values would be in line
661 with the findings of Schulz et al. (2017b), where stakeholders typically expressed a preference for both
662 efficiency and legality, as well as economic water values. This relationship was found and thus confirms
663 the qualitative research of Schulz et al. (2017b). This link is especially significant given that it relates
664 the level of governance-related values and of assigned values (as Finding 4), suggesting that these do
665 indeed combine in value landscapes, as proposed in the Value Landscapes Approach of Schulz et al.
666 (2017a).

667

668 *5.4 Impact of people's value landscapes on their water policy preferences (Hypothesis 2)*

669 *Finding 1: Self-transcendence and ecological water values of value landscape 1 relate negatively with*
670 *support for the Paraguay-Paraná Waterway (as an example of a water policy preference).*

671 In the preceding qualitative study (Schulz et al. 2017b), stakeholders tended to oppose the
672 construction of the Paraguay-Paraná Waterway when they also emphasised the importance of
673 ecological and cultural water values, as well as governance-related values such as social justice and
674 equity (i.e. democratic governance-related values), which are all related in value landscape 1 here.
675 One could thus plausibly expect a negative link between these values and support for the waterway,
676 not least also in line with environmental psychology literature on linkages between self-transcendence
677 and pro-environmental attitudes and behaviour (Dietz 2016; Schultz et al. 2005; Steg & de Groot 2012)
678 and a study of Bjornlund et al. (2013) who found that pro-environmental fundamental values go along
679 with support for pro-environmental water policies. However, only one value (ecological water values)
680 was found to display a statistically significant relationship with the expected direction in the full model.
681 In this case, mediation effects are only in part responsible for this (i.e. further unknown variables not
682 accounted for in our model may also be relevant) – if one deletes ecological water values from the
683 full model, the negative link between self-transcendence and the water policy preference becomes
684 statistically significant (p-value of 0.037; coefficient of -0.240). No mediation effect was found for
685 democratic governance-related values, despite its strong links to self-transcendence and cultural
686 water values in value landscape 1, which suggests that this value by itself is unrelated to opposition to
687 the waterway. The same applies to cultural water values.

688 *Finding 2: Self-enhancement (of value landscape 2) and economic water values relate positively with*
689 *support for the Paraguay-Paraná Waterway.*

690 Stakeholders in Schulz et al. (2017b) tended to support the waterway when they also emphasised
691 economic water values and governance-related values such as efficiency and order (i.e. economic
692 governance-related values), which are all related in value landscape 2 here. Thus it seemed plausible
693 that these values would relate positively with support for the project, not least considering the

694 environmental psychology literature on the negative links between self-enhancement values and pro-
695 environmental attitudes and behaviour (Dietz 2016; Schultz et al. 2005; Steg & de Groot 2012), as well
696 as the findings of Bjornlund et al. (2013) who reported that 'utilitarian values' (with a similar focus on
697 economic aspects) went along with support for water policies aimed at enhancing economic activities
698 in their survey. Again, only one value (self-enhancement) was found to display a statistically significant
699 relationship with the expected direction. Moderator effects (Baron & Kenny 1986) are in part
700 responsible – when deleting the moderating variable of cultural water values (which in line with
701 Preacher & Hayes 2008 was linked to economic water values via residual covariances, see Table
702 4/Appendix B), the positive link between economic water values and the water policy preference
703 becomes statistically significant (p-value of 0.028), with a coefficient of 0.329.

704 It seems plausible that, contrary to our initial expectations, economic governance-related values
705 relate negatively to support for the waterway (coefficient of -0.674 with a p-value of 0.093). In practice,
706 that would mean that concern for economic efficiency and legality of governance might combine with
707 opposition to the project, possibly due to a concern with corruption and waste of public funds. The p-
708 value of that link falls below the more lenient 0.1 threshold for statistical significance that is
709 occasionally applied, even if not typically recommended (El-Masri & Tawadrous 2013). While our
710 analysis should thus not be interpreted as conclusive empirical evidence on this specific link, it would
711 resonate with academic literature on the waste of public funds in the context of large infrastructure
712 projects in Mato Grosso (Crabb 2016) and Brazil more generally (Joly 2017; Signor et al. 2016),
713 especially under the centre-left governments of Presidents Luiz Inácio 'Lula' da Silva and Dilma
714 Rousseff (Armijo & Rhodes 2017). This issue was particularly salient during fieldwork in 2016, i.e. when
715 Brazilian news were dominated by the revelations about large-scale corruption following the
716 investigations within 'Operation Car Wash' (Melo 2016; Winter 2017) that eventually resulted in the
717 impeachment of President Dilma Rousseff (Santos & Guarnieri 2016).

718

719 **6 Implications, general discussion, and conclusions**

720 Implementing a Value Landscapes Approach in empirical research more generally may (i) help to
721 understand people's preferences and behaviour in water governance, including their water policy
722 preferences and (ii) may serve to assess the political legitimacy of water governance in a given place
723 and time by comparing values held by members of the general public with those values expressed in
724 actual water governance. Specific relations between values and water policy preferences were amply
725 discussed in the preceding sections. Here, instead, we aim to situate our research findings in the wider
726 literature. Our finding that preferences for or against the construction of a waterway across Mato
727 Grosso's Pantanal wetland can be linked to people's values is in line with the general environmental
728 psychology literature, which has a long history of establishing linkages between fundamental values,
729 other psychological constructs, and people's preferences (Dietz 2016; Fulton et al. 1996; Homer &
730 Kahle 1988; Steg & de Groot 2012; Steg 2016). Our study confirms what Manfredo et al. (2017a) have
731 called the 'embedded nature of values' in society; values are not just psychometric constructs that can
732 be measured via survey instruments, but are realised in many different ways in society, including in
733 material objects, such as plans to build a waterway in our case.

734 Understanding conflicts and controversies as conflicts of values is highly significant with practical
735 implications, given that value conflicts tend to activate people's emotions, escalate quickly, and often
736 persist over significant timespans (Illes et al. 2014; Kouzakova et al. 2012). Addressing such conflicts
737 requires particular conflict resolution techniques that go beyond a mere comparison of all
738 stakeholders' interests. Harinck and Druckman (2017) report that using the help of mediators who

739 affirm the positive qualities of other parties in joint negotiations might be a promising conflict
740 resolution strategy for value conflicts, because this reduces threats to the identity of each conflicting
741 party. Our findings suggest that the conflict around this water project is indeed a conflict of values as
742 proposed by Schulz et al. (2017b). This would explain its long conflict history and the emotional
743 disputes around it, which at an earlier stage attracted attention by local and international NGOs (da
744 Silva et al. 2004; Figueiredo et al. 2012; Leão et al. 2013).

745 Beyond our individual case study, our findings indicate that other classical environmental conservation
746 vs. economic development conflicts may be rooted in people's values, too. While such a statement is
747 in line with findings by environmental psychologists on linkages between values and environmental
748 attitudes or preferences (Dietz 2016; Schultz et al. 2005; Steg & de Groot 2012) and the finding of
749 Drews and van den Bergh (2016) that self-enhancement (and conservation) values might be correlated
750 with a preference for economic growth, we are not aware of previous research that has sought to
751 interpret these environment vs. development conflicts generally as conflicts of fundamental values.
752 The environment-development interface is more typically discussed from an economics or
753 international development perspective (e.g. Aguilar-Støen et al. 2016; Halkos & Managi 2017; Paavola
754 2002; Xepapadeas & Stefan 2014) or in the context of localised conflicts between environmental
755 conservation and economic activities (e.g. Arvor et al. 2018; Hoyman & McCall 2013; Martín-López et
756 al. 2011; Rajwade 2015).

757 Interpreting environment vs. development conflicts as conflicts of fundamental values would explain
758 why these are so widespread globally, including in Mato Grosso and Brazil (see e.g. Arvor et al. 2018;
759 Nascimento & Griffith 2012; Schulz et al. 2015; Zhouri 2010), and why they are so frequently perceived
760 as intractable and difficult to resolve. Moreover, it could explain why attempts to overcome the divide
761 between environmental conservation and economic development ring hollow to many, e.g. when
762 researchers express their discomfort with monetary valuation of the environment (e.g. Harvey 1996;
763 Kallis et al. 2013; Spangenberg & Settele 2010; Spash & Vatn 2006) or when they express their doubts
764 about the adequacy of the 'green growth' concept (e.g. Bina 2013; Death 2014; Schulz & Bailey 2014;
765 Springett 2013). It also suggests that individual cases of environment vs. development conflicts could
766 be addressed with conflict resolution techniques which have proven effective specifically for situations
767 of value conflict (see e.g. Harinck & Druckman 2017; Illes et al. 2014; Kouzakova et al. 2012), even if
768 the broader dynamics of conflict between environment and development dimensions are unlikely to
769 disappear.

770 Our structural equation model confirmed the existence of links between fundamental values and
771 assigned values that had been identified with different methodological approaches previously (Hicks
772 et al. 2015; Van Riper & Kyle 2014), especially the link between self-transcendence and assigning
773 ecological values to water. Yet, by including governance-related values as well, our study adds a new
774 facet of the value concept to the analysis that is not typically included in environmental psychology
775 research, despite its importance for water governance (Glenk & Fischer 2010; Grotenbreg &
776 Altamirano 2017) and public administration (Beck Jørgensen & Bozeman 2007; de Graaf et al. 2016;
777 Rutgers 2015; Tsanga Tabi & Verdon 2015). Further research on value landscapes, and the role of
778 governance-related values therein, should thus be conducted to evaluate their importance for
779 understanding water governance preferences, based on our initial findings here.

780 Finally, the empirical evidence presented in this study strengthens the case of political ecologists and
781 critical scholars who claim that water governance in Brazil is driven by elites and ignores preferences
782 of the public and weaker stakeholder groups (e.g. Ioris 2009; Lemos & de Oliveira 2004; Martins 2015;
783 Schmitt 2016; Siegmund-Schultze et al. 2015). The values and preferences expressed by the general
784 public in our survey do not match the values and preferences expressed by Mato Grosso's water

785 governance, i.e. the plans to build a waterway in the Pantanal wetland, as evidenced by the fact that
786 almost two thirds of respondents opposed it. The economic water values that would be realised
787 through the waterway may thus not align with the predominantly environmental values of water that
788 the majority of the population seems to prioritise. This points to problems with its political legitimacy,
789 if understood as majority support of the population (Bekkers & Edwards 2007). It may also indicate
790 that the pessimism of many water professionals in Mato Grosso about lacking environmental
791 awareness among the general population (Schulz & Ioris 2017) may not necessarily be justified. Rather,
792 environmental degradation would be the result of the disproportional political clout of a minority who
793 prioritise economic water values. Not least, our study also serves to demonstrate that statistical
794 analysis techniques have their place in answering questions of relevance to political ecologists, whose
795 publications are dominated by qualitative and conceptual research approaches.

796 Conceivably, the research approach adopted here could serve for the analysis of other controversial
797 projects, e.g. the construction of further waterways and large-scale dams in the Brazilian Amazon (see
798 e.g. Fearnside 2015), as well as any other aspect of water governance and environmental governance
799 more generally that may be characterised by conflicting underlying value landscapes.

800

801 **References**

802 Aguilar-Støen, M., Hansen, A., McNeill, D., & Stølen, K.-A. (2016): Introduction to the Special Issue:
803 Frontiers of Research on Development and the Environment, in: *Forum for Development Studies*, vol.
804 43(1): 1-4.

805 Ajzen, I. (1985): From Intentions to Actions: A Theory of Planned Behavior, in: Kuhl, J., & Beckmann,
806 J. (eds.): *Action Control: From Cognition to Behavior*, Berlin & Heidelberg, Germany: Springer-Verlag,
807 11-39.

808 Ajzen, I. (1991): The theory of planned behavior, in: *Organizational Behavior and Human Decision*
809 *Processes*, vol. 50(2): 179-211.

810 Akhmouch, A. & Correia, F.N. (2016): The 12 OECD principles on water governance – When science
811 meets policy, in: *Utilities Policy*, vol. 43: 14-20.

812 ANA = Agência Nacional de Águas (2006): *Região Hidrográfica do Paraguai* [map], ANA. Available
813 online:

814 http://metadados.ana.gov.br/geonetwork/srv/en/resources.get?id=114&fname=REGIAO_HIDROGR
815 [AFICA_DO_PARAGUAI.pdf&access=private](http://metadados.ana.gov.br/geonetwork/srv/en/resources.get?id=114&fname=REGIAO_HIDROGR) (last accessed 20/3/2017).

816 ANTAQ = Agência Nacional de Transportes Aquaviários (2013): Relatório Técnico: Bacia do Paraguai,
817 in: ANTAQ, UFSC = Universidade Federal de São Carlos, & LabTrans = Laboratório de Transportes e
818 Logística (eds.): *Plano Nacional de Integração Hidroviária: Desenvolvimento de Estudos e Análises*
819 *das Hidrovias Brasileiras e suas Instalações Portuárias com Implantação de Base de Dados*
820 *Georreferenciada e Sistema de Informações Geográficas*, Brasília & Florianópolis, Brazil: ANTAQ,
821 UFSC & LabTrans.

822 Antunes, P., Kallis, G., Videira, N., & Santos, R. (2009): Participation and evaluation for sustainable
823 river basin governance, in: *Ecological Economics*, vol. 68: 931-939.

824 Arévalo, D. (2015): *Vice-governador discute hidrovía com investidores dos EUA*, Governo do Estado
825 de Mato Grosso, 12 February 2015. Available online:

- 826 [http://www3.mt.gov.br/editorias/infraestrutura/vice-governador-discute-hidrovia-com-](http://www3.mt.gov.br/editorias/infraestrutura/vice-governador-discute-hidrovia-com-investidores-dos-eua/135529)
827 [investidores-dos-eua/135529](http://www3.mt.gov.br/editorias/infraestrutura/vice-governador-discute-hidrovia-com-investidores-dos-eua/135529) (last accessed 26/2/2018).
- 828 Arias-Arévalo, P., Martín-López, B., & Gómez-Baggethun, E. (2017): Exploring intrinsic, instrumental,
829 and relational values for sustainable management of social-ecological systems, in: *Ecology and*
830 *Society*, vol. 22(4): 43.
- 831 Armijo, L.E. & Rhodes, S.D. (2017): Explaining infrastructure underperformance in Brazil: cash,
832 political institutions, corruption, and policy *Gestalts*, in: *Policy Studies*, vol. 38(3): 231-247.
- 833 Arvor, D., Daugeard, M., Tritsch, I., De Mello-Thery, N.A., Thery, H., & Dubreuil, V. (2018): Combining
834 socioeconomic development with environmental governance in the Brazilian Amazon: the Mato
835 Grosso agricultural frontier at a tipping point, in: *Environment, Development and Sustainability*, vol.
836 20(1): 1-22.
- 837 Bandalos, D.L. (2014): Relative Performance of Categorical Diagonally Weighted Least Squares and
838 Robust Maximum Likelihood Estimation, in: *Structural Equation Modeling*, vol. 21: 102-116.
- 839 Barber, M. & Jackson, S. (2011): Aboriginal water values and resource development pressures in the
840 Pilbara region of north-west Australia, in: *Australian Aboriginal Studies*, issue 2: 32-49.
- 841 Bark, R., MacDonald, D.H., Connor, J., Crossman, N., & Jackson, S. (2011): Water Values, in: Prosser,
842 I.P. (ed.): *Water: Science and Solutions for Australia*, Collingwood, Australia: CSIRO Publishing, 17-27.
- 843 Baron, R.M. & Kenny, D.A. (1986): The Moderator-Mediator Variable Distinction in Social
844 Psychological Research: Conceptual, Strategic, and Statistical Considerations, in: *Journal of*
845 *Personality and Social Psychology*, vol. 51(6): 1173-1182.
- 846 Beck Jørgensen, T. & Bozeman, B. (2007): Public Values: An Inventory, in: *Administration & Society*,
847 vol. 39(3): 354-381.
- 848 Bekkers, V. & Edwards, A. (2007): Legitimacy and Democracy: A Conceptual Framework for Assessing
849 Governance Practices, in: Bekkers, V., Dijkstra, G., Edwards, A., & Fenger, M. (eds.): *Governance and*
850 *the Democratic Deficit: Assessing the Democratic Legitimacy of Governance Practices*, Aldershot, UK
851 & Burlington, USA: Ashgate Publishing, 35-60.
- 852 Bengston, D.N. (1994): Changing forest values and ecosystem management, in: *Society & Natural*
853 *Resources*, vol. 7(6): 515-533.
- 854 Berry, K.A., Jackson, S., Saito, L., & Forline, L. (2018): Reconceptualising Water Quality Governance to
855 Incorporate Knowledge and Values: Case studies from Australian and Brazilian Indigenous
856 Communities, in: *Water Alternatives*, vol. 11(1): 40-60.
- 857 Bina, O. (2013): The green economy and sustainable development: an uneasy balance? in:
858 *Environment and Planning C: Government and Policy*, vol. 31: 1023-1047.
- 859 Bjornlund, H. & O'Callaghan, B. (2005): A Comparison of Implicit Values and Explicit Prices of Water,
860 in: *Pacific Rim Property Research Journal*, vol. 11(3): 316-331.
- 861 Bjornlund, H., Parrack, C., & de Loë, R.C. (2013): Segmenting the Urban and Rural Populations of
862 Southern Alberta for Improved Understanding of Policy Preferences for Water Reallocation, in:
863 *Society & Natural Resources*, vol. 26(11): 1330-1350.

864 Braitto, M.T., Böck, K., Flint, C., Muhar, A., Muhar, S., & Penker, M. (2017): Human-nature
865 relationships and linkages to environmental behaviour, in: *Environmental Values*, vol. 26: 365-389.

866 Brown, G. (2013): Relationships between spatial and non-spatial preferences and place-based values
867 in national forests, in: *Applied Geography*, vol. 44: 1-11.

868 Brown, G. & Reed, P. (2000): Validation of a Forest Values Typology for Use in National Forest
869 Planning, in: *Forest Science*, vol. 46(2): 240-247.

870 Brown, T.C. (1984): The Concept of Value in Resource Allocation, in: *Land Economics*, vol. 60(3), 231-
871 246.

872 Calheiros, D.F., de Oliveira, M.D., & Padovani, C.R. (2012): Hydro-ecological Processes and
873 Anthropogenic Impacts on the Ecosystem Services of the Pantanal Wetland, in: Ioris, A.A.R. (ed.):
874 *Tropical Wetland Management: The South-American Pantanal and the International Experience*,
875 Farnham, UK: Ashgate Publishing, 29-57.

876 Chan, K.M.A., Satterfield, T., & Goldstein, J. (2012): Rethinking ecosystem services to better address
877 and navigate cultural values, in: *Ecological Economics*, vol. 74: 8-18.

878 Cooper, B. (2017): What drives compliance? An application of the theory of planned behaviour to
879 urban water restrictions using structural equation modelling, in: *Applied Economics*, vol. 49(14):
880 1426-1439.

881 Corral-Verdugo, V., Carrus, G., Bonnes, M., Moser, G., & Sinha, J.B.P. (2008): Environmental Beliefs
882 and Endorsement of Sustainable Development Principles in Water Conservation: Toward a New
883 *Human Interdependence Paradigm Scale*, in: *Environment and Behavior*, vol. 40(5): 703-725,

884 Crabb, L.A.H. (2016): *Elites and carbon offsetting in Brazil: A critique of the 2014 FIFA World Cup in*
885 *Mato Grosso*, PhD thesis, Essex, UK: Essex Business School, University of Essex.

886 Cramer, L.A., Kennedy, J.J., Krannich, R.S., & Quigley, T.M. (1993): Changing Forest Service Values
887 and Their Implications for Land Management Decisions Affecting Resource-Dependent Communities,
888 in: *Rural Sociology*, vol. 58(3): 475-491.

889 Crompton, T., Brewer, J., Chilton, P., & Kasser, T. (2010): *Common Cause: The Case for Working with*
890 *our Cultural Values*, Woking, UK: WWF-UK.

891 da Silva, H.P., Rocha, N.M., & Ikeda-Castrillon, S.K. (2004): O impacto da proposta de implementação
892 da Hidrovia Paraguai-Paraná, na visão de diversos setores da sociedade em Cáceres, MT, in: *Anais do*
893 *IV Simpósio sobre Recursos Naturais e Sócio-econômicos do Pantanal (SIMPAN)*, Corumbá, Brazil, 23-
894 26 November.

895 Daly, H.E. (1990): Toward some operational principles of sustainable development, in: *Ecological*
896 *Economics*, vol. 2: 1-6.

897 de Graaf, G., Huberts, L., & Smulders, R. (2016): Coping With Public Value Conflicts, in:
898 *Administration & Society*, vol. 48(9): 1101-1127.

899 Death, C. (2014): The Green Economy in South Africa: Global Discourses and Local Politics, in:
900 *Politikon*, vol. 41(1): 1-22.

901 Dietz, T. (2016): Environmental value, in: Brosch, T. & Sander, D. (eds.): *Handbook of Value: Perspectives from Economics, Neuroscience, Philosophy, Psychology and Sociology*, Oxford, UK: Oxford University Press, 329-349.

902
903

904 Dietz, T., Fitzgerald, A., & Shwom, R. (2005): Environmental Values, in: *Annual Review of Environment and Resources*, vol. 30: 335-372.

905

906 Drews, S. & van den Bergh, J.C.J.M. (2016): Public views on economic growth, the environment and prosperity: Results of a questionnaire survey, in: *Global Environmental Change*, vol. 39: 1-14.

907

908 Du Pisani, J.A. (2006): Sustainable development – historical roots of the concept, in: *Environmental Sciences*, vol. 3(2): 83-96.

909

910 El-Masri, M.M. & Tawadrous, D. (2013): Essentials of Epidemiologic Measures and Data Interpretation, in: Korniewicz, D.M. (ed.): *Infection Control for Advanced Practice Professionals*, Lancaster, USA: DEStech Publications, Inc., 49-67.

911
912

913 Euzen, A. & Morehouse, B. (2011): Water: What values? in: *Policy and Society*, vol. 30(4): 237-247.

914

915 Evans, L., Maio, G.R., Corner, A., Hodgetts, C.J., Ahmed, S., & Hahn, U. (2013): Self-interest and pro-environmental behaviour, in: *Nature Climate Change*, vol. 3: 122-125.

916

917 Falk, A. & Szech, N. (2013): Morals and Markets, in: *Science*, vol. 340(6133): 707-711.

918

919 Fearnside, P.M. (2001): Soybean cultivation as a threat to the environment in Brazil, in: *Environmental Conservation*, vol. 28(1): 23-38.

920

921 Fearnside, P.M. (2015): Amazon dams and waterways: Brazil's Tapajós Basin plans, in: *Ambio*, vol. 44(5): 426-439.

922

923 Figueiredo, D.M., Dores, E.F.G.C., Paz, A.R., & Souza, C.F. (2012): Availability, Uses and Management of Water in the Brazilian Pantanal, in: Ioris, A.A.R. (ed.): *Tropical Wetland Management: The South-American Pantanal and the International Experience*, Farnham, UK: Ashgate Publishing, 59-98.

924

925 Floress, K., García de Jalón, S., Church, S.P., Babin, N., Ulrich-Schad, J.D., & Prokopy, L.S. (2017): Toward a theory of farmer conservation attitudes: Dual interests and willingness to take action to protect water quality, in: *Journal of Environmental Psychology*, vol. 53: 73-80.

926

927 Fulton, D.C., Manfredo, M.J., & Lipscomb, J. (1996): Wildlife Value Orientations: A Conceptual and Measurement Approach, in: *Human Dimensions of Wildlife*, vol. 1(2): 24-47.

928

929 Garson, G.D. (2015): *Structural Equation Modeling*, Asheboro, USA: Statistical Associates Publishers.

930

931 Gaziano, C. (2005): Comparative Analysis of Within-Household Respondent Selection Techniques, in: *Public Opinion Quarterly*, vol. 69(1): 124-157.

932

933 Gibbs, L.M. (2010): "A beautiful soaking rain": environmental value and water beyond Eurocentrism, in: *Environment and Planning D: Society and Space*, vol. 28(2): 363-378.

934

935 Gioia, C.J. (1987): The Great Waterways project of South America, in: *Project Appraisal*, vol. 2(4): 243-250.

936

937 Glenk, K. & Fischer, A. (2010): Insurance, prevention or just wait and see? Public preferences for water management strategies in the context of climate change, in: *Ecological Economics*, vol. 69(11): 2279-2291.

938

- 939 Gottgens, J.F., Perry, J.E., Fortney, R.H., Meyer, J.E., Benedict, M., & Rood, B.E. (2001): The
 940 Paraguay–Paraná Hidrovía: Protecting the Pantanal with Lessons from the Past, in: *BioScience*, vol.
 941 51(4): 301-308.
- 942 Grizzetti, B., Liquete, C., Antunes, P., Carvalho, L., Geamănă, N., Giucă, R., Leone, M., McConnell, S.,
 943 Preda, E., Santos, R., Turkelboom, F., Vădineanu, A., & Woods, H. (2016): Ecosystem services for
 944 water policy: Insights across Europe, in: *Environmental Science & Policy*, vol. 66: 179-190.
- 945 Groenfeldt, D. (2013): *Water ethics: A values approach to solving the water crisis*, Abingdon, UK &
 946 New York, USA: Routledge.
- 947 Grotenbreg, S. & Altamirano, M. (2017): Government facilitation of external initiatives: how Dutch
 948 water authorities cope with value dilemmas, in: *International Journal of Water Resources*
 949 *Development*, Epub ahead of print: doi: 10.1080/07900627.2017.1374930.
- 950 Hackbart, V.C.S., de Lima, G.T.N.P., & dos Santos, R.F. (2017): Theory and practice of water
 951 ecosystem services valuation: Where are we going? in: *Ecosystem Services*, vol. 23: 218-227.
- 952 Halkos, G. & Managi, S. (2017): Recent advances in empirical analysis on growth and environment:
 953 introduction, in: *Environment and Development Economics*, vol. 22(6): 649-657.
- 954 Hamilton, S.K. (1999): Potential Effects of a Major Navigation Project (Paraguay-Paraná Hidrovía) on
 955 Inundation in the Pantanal Floodplains, in: *Regulated Rivers: Research & Management*, vol. 15: 289-
 956 299.
- 957 Harinck, F. & Druckman, D. (2017): Do Negotiation Interventions Matter? Resolving Conflicting
 958 Interests and Values, in: *Journal of Conflict Resolution*, vol. 61(1): 29-55.
- 959 Harvey, D. (1996): *Justice, Nature and the Geography of Difference*, Cambridge, USA: Blackwell
 960 Publishers.
- 961 Henry, A.D. & Dietz, T. (2012): Understanding Environmental Cognition, in: *Organization &*
 962 *Environment*, vol. 25(3): 238-258.
- 963 Hermans, L.M., van Halsema, G.E., & Mahoo, H.F. (2006): Building a mosaic of values to support local
 964 water resources management, in: *Water Policy*, vol. 8(5): 415-434.
- 965 Hicks, C.C., Cinner, J.E., Stoeckl, N., & McClanahan, T.R. (2015): Linking ecosystem services and
 966 human-values theory, in: *Conservation Biology*, vol. 29(5): 1471-1480.
- 967 Homer, P.M. & Kahle, L.R. (1988): A Structural Equation Test of the Value-Attitude-Behavior
 968 Hierarchy, in: *Journal of Personality and Social Psychology*, vol. 54(4): 638-646.
- 969 Hoyman, M.M. & McCall, J.R. (2013): Is there trouble in paradise? The perspectives of Galapagos
 970 community leaders on managing economic development and environmental conservation through
 971 ecotourism policies and the Special Law of 1998, in: *Journal of Ecotourism*, vol. 12(1): 33-48.
- 972 Hu, L. & Bentler, P.M. (1999): Cutoff Criteria for Fit Indexes in Covariance Structure Analysis:
 973 Conventional Criteria Versus New Alternatives, in: *Structural Equation Modeling*, vol. 6(1): 1-55.
- 974 Hurlimann, A., Hemphill, E., McKay, J., & Geursen, G. (2008): Establishing components of community
 975 satisfaction with recycled water use through a structural equation model, in: *Journal of*
 976 *Environmental Management*, vol. 88(4): 1221-1232.

- 977 IBGE = Instituto Brasileiro de Geografia e Estatística (2011a): *Censo Demográfico 2010: Resultados da*
978 *Sinopse por Setores Censitários (Mato Grosso) - 01/07/11* [dataset]. Available online:
979 [ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Sinopse/Agregados_por_Setores_Censitarios/](ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Sinopse/Agregados_por_Setores_Censitarios/Base_informacoes_setores2010_sinopse_MT.zip)
980 [Base_informacoes_setores2010_sinopse_MT.zip](ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Sinopse/Agregados_por_Setores_Censitarios/Base_informacoes_setores2010_sinopse_MT.zip) (last accessed 20/3/2017).
- 981 IBGE (2011b): *Base de informações do Censo Demográfico 2010: Resultados do Universo por setor*
982 *censitário*, Documentação do Arquivo, Rio de Janeiro: IBGE.
- 983 IBGE (2011c): *Censo Demográfico 2010: Cadastro Nacional de Endereços para Fins Estatísticos (Mato*
984 *Grosso) - 25/11/11* [dataset]. Available online:
985 [ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Cadastro_Nacional_de_Enderecos_Fins_Est](ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Cadastro_Nacional_de_Enderecos_Fins_Estatisticos/MT/)
986 [atisticos/MT/](ftp://ftp.ibge.gov.br/Censos/Censo_Demografico_2010/Cadastro_Nacional_de_Enderecos_Fins_Estatisticos/MT/) (last accessed 20/3/2017).
- 987 Illes, R., Ellemers, N., & Harinck, F. (2014): Mediating Value Conflicts, in: *Conflict Resolution*
988 *Quarterly*, vol. 31(3): 331-354.
- 989 Ioris, A.A.R. (2009): Water reforms in Brazil: opportunities and constraints, in: *Journal of*
990 *Environmental Planning and Management*, vol. 52(6): 813-832.
- 991 Ioris, A.A.R. (2012): The Positioned Construction of Water Values: Pluralism, Positionality and Praxis,
992 in: *Environmental Values*, vol. 21: 143-162.
- 993 Ioris, A.A.R. (2013): Rethinking Brazil's Pantanal Wetland: Beyond Narrow Development and
994 Conservation Debates, in: *The Journal of Environment & Development*, vol. 22(3): 239-260.
- 995 Ioris, A.A.R. (2016): Controversial Frontiers of Agricultural Development and Environmental Change,
996 in: Ioris, A.A.R. (ed.): *Agriculture, Environment and Development: International Perspectives on*
997 *Water, Land and Politics*, London, UK: Palgrave Macmillan, 221-250.
- 998 Iribarnegaray, M.A. & Seghezze, L. (2012): Governance, Sustainability and Decision Making in Water
999 and Sanitation Management Systems, in: *Sustainability*, vol. 4: 2922-2945.
- 1000 Ives, C.D. & Fischer, J. (2017): The self-sabotage of conservation: reply to Manfredo et al., in:
1001 *Conservation Biology*, vol. 31(6): 1483-1485.
- 1002 Ives, C.D. & Kendal, D. (2014): The role of social values in the management of ecological systems, in:
1003 *Journal of Environmental Management*, vol. 144: 67-72.
- 1004 Johnston, P., Everard, M., Santillo, D., & Robèrt, K.-H. (2007): Reclaiming the Definition of
1005 Sustainability, in: *Environmental Science and Pollution Research*, vol. 14(1): 60-66.
- 1006 Joly, M. (2017): Corruption: The shortcut to disaster, in: *Sustainable Production and Consumption*,
1007 vol. 10: 133-156.
- 1008 Junk, W.J., Nunes da Cunha, C., Wantzen, K.M., Petermann, P., Strüssman, C., Marques, M.I., & Adis,
1009 J. (2006): Biodiversity and its conservation in the Pantanal of Mato Grosso, Brazil, in: *Aquatic*
1010 *Sciences*, vol. 68: 278-309.
- 1011 Kaida, N. & Kaida, K. (2016): Facilitating Pro-environmental Behavior: The Role of Pessimism and
1012 Anthropocentric Environmental Values, in: *Social Indicators Research*, vol. 126(3): 1243-1260.
- 1013 Kallis, G., Gómez-Baggethun, E., & Zografos, C. (2013): To value or not to value? That is not the
1014 question, in: *Ecological Economics*, vol. 94: 97-105.

- 1015 Kilbourne, W., Grünhagen, M., & Foley, J. (2005): A cross-cultural examination of the relationship
1016 between materialism and individual values, in: *Journal of Economic Psychology*, vol. 26(5): 624-641.
- 1017 Kline, R.B. (2011): *Principles and Practice of Structural Equation Modeling*, 3rd ed., New York, USA:
1018 The Guilford Press.
- 1019 Kooiman, J. & Jentoft, S. (2009): Meta-Governance: Values, Norms and Principles, and the Making of
1020 Hard Choices, in: *Public Administration*, vol. 87(4): 818-836.
- 1021 Kouzakova, M., Ellemers, N., Harinck, F., & Scheepers, D. (2012): The Implications of Value Conflict:
1022 How Disagreement on Values Affects Self-Involvement and Perceived Common Ground, in:
1023 *Personality and Social Psychology Bulletin*, vol. 38(6): 798-807.
- 1024 Kuzdas, C., Wiek, A., Warner, B., Vignola, R., & Morataya, R. (2014): Sustainability Appraisal of Water
1025 Governance Regimes: The Case of Guanacaste, Costa Rica, in: *Environmental Management*, vol.
1026 54(2): 205-222.
- 1027 Lathuillière, M.J., Johnson, M.S., Galford, G.L., & Couto, E.G. (2014): Environmental footprints show
1028 China and Europe's evolving resource appropriation for soybean production in Mato Grosso, Brazil,
1029 in: *Environmental Research Letters*, vol. 9(7): 074001.
- 1030 Leão, D.d.S., El Hage, P.P.F., & Bampi, A.C. (2013): Sociedade Civil de Cáceres/MT no Monitoramento
1031 da Hidrovia Paraguai-Paraná (HPP) no Pantanal Mato-Grossense, in: *Revista GeoPantanal*, vol. 8(14):
1032 46-66.
- 1033 Lemos, M.C. & de Oliveira, J.L.F. (2004): Can Water Reform Survive Politics? Institutional Change and
1034 River Basin Management in Ceará, Northeast Brazil, in: *World Development*, vol. 32(12): 2121-2137.
- 1035 Lieberherr, E., Klinke, A., & Finger, M. (2012): Towards Legitimate Water Governance? The partially
1036 privatized Berlin waterworks, in: *Public Management Review*, vol. 14(7): 923-946.
- 1037 Lockwood, M. (1999): Humans Valuing Nature: Synthesising Insights from Philosophy, Psychology
1038 and Economics, in: *Environmental Values*, vol. 8: 381-401.
- 1039 Lockwood, M., Davidson, J., Curtis, A., Stratford, E., & Griffith, R. (2010): Governance principles for
1040 natural resource management, in: *Society & Natural Resources*, vol. 23(10), 986–1001.
- 1041 Lukasiewicz, A., Bowmer, K., Syme, G.J., & Davidson, P. (2013): Assessing Government Intentions for
1042 Australian Water Reform Using a Social Justice Framework, in: *Society & Natural Resources*, vol.
1043 26(11): 1314-1329.
- 1044 Manfredo, M.J., Bruskotter, J.T., Teel, T.L., Fulton, D., Schwartz, S.H., Arlinghaus, R., Oishi, S., Uskul,
1045 A.K., Redford, K., Kitayama, S., & Sullivan, L. (2017a): Why social values cannot be changed for the
1046 sake of conservation, in: *Conservation Biology*, vol. 31(4): 772-780.
- 1047 Manfredo, M.J., Bruskotter, J.T., Teel, T.L., Fulton, D.C., Oishi, S., Uskul, A.K., Redford, K.H., Schwartz,
1048 S.H., Arlinghaus, R., Kitayama, S., & Sullivan, L. (2017b): Revisiting the challenge of intentional value
1049 shift: reply to Ives and Fischer, in: *Conservation Biology*, vol. 31(6): 1486-1487.
- 1050 Manning, R., Valliere, W., & Minter, B. (1999): Values, Ethics, and Attitudes Toward National Forest
1051 Management: An Empirical Study, in: *Society & Natural Resources*, vol. 12(5): 421-436.

- 1052 Martín-López, B., García-Llorente, M., Palomo, I., & Montes, C. (2011): The conservation against
 1053 development paradigm in protected areas: Valuation of ecosystem services in the Doñana social-
 1054 ecological system (southwestern Spain), in: *Ecological Economics*, vol. 70(8): 1481-1491.
- 1055 Martín-Ortega, J., Ferrier, R.C., & Gordon, I.J. (2015): Water ecosystem services: Moving forward, in:
 1056 Martín-Ortega, J., Ferrier, R.C., Gordon, I.J., & Khan, S. (eds.): *Water ecosystem services: a global
 1057 perspective*, Cambridge, UK: Cambridge University Press, 170-173.
- 1058 Martínez-Alier, J., Munda, G., & O'Neill, J. (1998): Weak comparability of values as a foundation for
 1059 ecological economics, in: *Ecological Economics*, vol. 26(3): 277-286.
- 1060 Martins, R.C. (2015): Boundaries between Inequality and Difference in Water Governance, in:
 1061 *Ambiente & Sociedade*, vol. 18(1): 211-228.
- 1062 McIntyre, N., Moore, J., & Yuan, M. (2008): A Place-Based, Values-Centered Approach to Managing
 1063 Recreation on Canadian Crown Lands, in: *Society & Natural Resources*, vol. 21(8): 657-670.
- 1064 Melo, M.A. (2016): Crisis and Integrity in Brazil, in: *Journal of Democracy*, vol. 27(2): 50-65.
- 1065 Milman, A. & Short, A. (2008): Incorporating resilience into sustainability indicators: An example for
 1066 the urban water sector, in: *Global Environmental Change*, vol. 18(4): 758-767.
- 1067 Moreno Pires, S., Teles, F., & Ferreira da Cruz, N. (2017): Quality of local governance and sustainable
 1068 development: a review of normative principles, paper presented at: *23rd Annual International
 1069 Sustainable Development Research Society (ISDRS) Conference*, Universidad de los Andes, Bogotá,
 1070 Colombia, 14-16 June.
- 1071 Moss, T. & Newig, J. (2010): Multilevel Water Governance and Problems of Scale: Setting the Stage
 1072 for a Broader Debate, in: *Environmental Management*, vol. 46(1): 1-6.
- 1073 Mostert, E. (2015): Who should do what in environmental management? Twelve principles for
 1074 allocating responsibilities, in: *Environmental Science & Policy*, vol. 45: 123-131.
- 1075 Nascimento, A. & Griffith, J.J. (2012): Environmental Philosophy in Brazil: Roots, Intellectual Culprits,
 1076 and New Directions, in: *Environmental Ethics*, vol. 34: 379-397.
- 1077 Norton, B.G. (2017): A Situational Understanding of Environmental Values and Evaluation, in:
 1078 *Ecological Economics*, vol. 138: 242-248.
- 1079 Norton, B.G. & Steinemann, A.C. (2001): Environmental Values and Adaptive Management, in:
 1080 *Environmental Values*, vol. 10(4): 473-506.
- 1081 Paavola, J. (2002): Environment and Development: Dissecting the Connections, in: *Forum for
 1082 Development Studies*, vol. 29(1): 5-31.
- 1083 Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R.T., Başak Dessane, E.,
 1084 Islar, M., Kelemen, E., Maris, V., Quaas, M., Subramanian, S.M., Wittmer, H., Adlan, A., Ahn, S.E., Al-
 1085 Hafedh, Y.S., Amankwah, E., Asah, S.T., Berry, P., Bilgin, A., Breslow, S.J., Bullock, C., Cáceres, D.,
 1086 Daly-Hassen, H., Figueroa, E., Golden, C.D., Gómez-Baggethun, E., González-Jiménez, D., Houdet, J.,
 1087 Keune, H., Kumar, R., Ma, K., May, P.H., Mead, A., O'Farrell, P., Pandit, R., Pengue, W., Pichis-
 1088 Madruga, R., Popa, F., Preston, S., Pacheco-Balanza, D., Saarikoski, H., Strassburg, B.B., van den Belt,
 1089 M., Verma, M., Wickson, F., & Yagi, N. (2017): Valuing nature's contributions to people: the IPBES
 1090 approach, in: *Current Opinion in Environmental Sustainability*, vol. 26: 7-16.

- 1091 Patrick, M.J. (2014): The Cycles and Spirals of Justice in water-allocation decision making, in: *Water*
1092 *International*, vol. 39(1): 63-80.
- 1093 Peine, E.K. (2013): Trading on Pork and Beans: Agribusiness and the Construction of the Brazil-China-
1094 Soy-Pork Commodity Complex, in: James Jr., H.S. (ed.): *The Ethics and Economics of Agrifood*
1095 *Competition*, The International Library of Environmental, Agricultural and Food Ethics vol. 20,
1096 Dordrecht, Netherlands: Springer Science+Business Media, 193-210.
- 1097 Perreault, T. (2014): What kind of governance for what kind of equity? Towards a theorization of
1098 justice in water governance, in: *Water International*, vol. 39(2): 233-245.
- 1099 Pires, M.A.F. & da Silva, P.J. (2009): Hidrovia Paraná-Paraguai: um eixo de desenvolvimento,
1100 integração e sustentabilidade para a América do Sul, in: *Engenharia*, vol. 592: 132-136.
- 1101 Poortinga, W., Steg, L., & Vlek, C. (2004): Values, Environmental Concern, and Environmental
1102 Behavior: A Study Into Household Energy Use, in: *Environment and Behavior*, vol. 36(1): 70-93.
- 1103 Pradhananga, A.K., Davenport, M.A., Fulton, D.C., Maruyama, G.M., & Current, D. (2017): An
1104 Integrated Moral Obligation Model for Landowner Conservation Norms, in: *Society & Natural*
1105 *Resources*, vol. 30(2): 212-227.
- 1106 Preacher, K.J. & Hayes, A.F. (2008): Asymptotic and resampling strategies for assessing and
1107 comparing indirect effects in multiple mediator models, in: *Behavior Research Methods*, vol. 40(3):
1108 879-891.
- 1109 Rahnama, H. & Rajabpour, S. (2017): Identifying effective factors on consumers' choice behavior
1110 toward green products: the case of Tehran, the capital of Iran, in: *Environmental Science and*
1111 *Pollution Research*, vol. 24(1): 911-925.
- 1112 Rajwade, A. (2015): The Indian Ocean Archipelagos: A Comparative Study of their Conservation vs.
1113 Development Spectrum, in: *Local Government Quarterly*, vol. 85(1): 66-79.
- 1114 Raymond, C.M. & Kenter, J.O. (2016): Transcendental values and the valuation and management of
1115 ecosystem services, in: *Ecosystem Services*, vol. 21(B): 241-257.
- 1116 Rokeach, M. (1973): *The Nature of Human Values*, New York, USA: The Free Press.
- 1117 Rosseel, Y. (2017): *The lavaan tutorial*, Ghent, Belgium: Department of Data Analysis, Ghent
1118 University. Available online: <http://lavaan.ugent.be/tutorial/tutorial.pdf> (last accessed 16/2/2018).
- 1119 Rutgers, M.R. (2015): As Good as It Gets? On the Meaning of Public Value in the Study of Policy and
1120 Management, in: *The American Review of Public Administration*, vol. 45(1): 29-45.
- 1121 Sabatier, P.A. (1988): An advocacy coalition framework of policy change and the role of policy-
1122 oriented learning therein, in: *Policy Sciences*, vol. 21(2-3): 129-168.
- 1123 Sabatier, P.A. & Weible, C.M. (2007): The Advocacy Coalition Framework: Innovations and
1124 Clarifications, in: Sabatier, P.A. (ed.): *Theories of the Policy Process*, 2nd ed., Boulder, USA: Westview
1125 Press, 189-220.
- 1126 Saliba, B.C., Bush, D.B., Martin, W.E., & Brown, T.C. (1987): Do Water Market Prices Appropriately
1127 Measure Water Values? in: *Natural Resources Journal*, vol. 27(3): 617-651.

- 1128 Salvaggio, M., Futrell, R., Batson, C.D., & Brents, B.G. (2014): Water scarcity in the desert metropolis:
 1129 how environmental values, knowledge and concern affect Las Vegas residents' support for water
 1130 conservation policy, in: *Journal of Environmental Planning and Management*, vol. 57(4): 588-611.
- 1131 Sanderson, M.R., Bergtold, J.S., Heier Stamm, J.L., Caldas, M.M., & Ramsey, S.M. (2017): Bringing the
 1132 "social" into sociohydrology: Conservation policy support in the Central Great Plains of Kansas, USA,
 1133 in: *Water Resources Research*, vol. 53(8): 6725-6743.
- 1134 Santos, F. & Guarnieri, F. (2016): From Protest to Parliamentary Coup: An Overview of Brazil's Recent
 1135 History, in: *Journal of Latin American Cultural Studies*, vol. 25(4): 485-494.
- 1136 Schmitt, T. (2016): Immer Ärger mit der Materialität? – Politische Ökologie und das Dispositiv der
 1137 Dürre im Nordosten Brasiliens, in: *Geographica Helvetica*, vol. 71(4): 229-244.
- 1138 Schröter, M., van der Zanden, E.H., van Oudenhoven, A.P.E., Remme, R.P., Serna-Chavez, H.M., de
 1139 Groot, R.S., & Opdam, P. (2014): Ecosystem Services as a Contested Concept: A Synthesis of Critique
 1140 and Counter-Arguments, in: *Conservation Letters*, vol. 7(6): 514-523.
- 1141 Schultz, P.W., Gouveia, V.V., Cameron, L.D., Tankha, G., Schmuck, P., & Franěk, M. (2005): Values
 1142 and their Relationship to Environmental Concern and Conservation Behavior, in: *Journal of Cross-
 1143 Cultural Psychology*, vol. 36(4): 457-475.
- 1144 Schulz, C. (2018): Dimensions of good governance: a review and empirical study of public
 1145 preferences for governance-related values in water governance, in: *Wiley Interdisciplinary Reviews:
 1146 Water*, doi:10.1002/wat2.1322.
- 1147 Schulz, C. & Bailey, I. (2014): The green economy and post-growth regimes: opportunities and
 1148 challenges for economic geography, in: *Geografiska Annaler: Series B, Human Geography*, vol. 96(3):
 1149 277-291.
- 1150 Schulz, C. & Ioris, A.A.R. (2017): The Paradox of Water Abundance in Mato Grosso, Brazil, in:
 1151 *Sustainability*, vol. 9(10): 1796.
- 1152 Schulz, C., Ioris, A.A.R., Martin-Ortega, J., & Glenk, K. (2015): Prospects for Payments for Ecosystem
 1153 Services in the Brazilian Pantanal: A Scenario Analysis, in: *The Journal of Environment &
 1154 Development*, vol. 24(1): 26-53.
- 1155 Schulz, C., Martin-Ortega, J., Glenk, K., & Ioris, A.A.R. (2017a): The Value Base of Water Governance:
 1156 A Multi-Disciplinary Perspective, in: *Ecological Economics*, vol. 131: 241-249.
- 1157 Schulz, C., Martin-Ortega, J., Ioris, A.A.R., & Glenk, K. (2017b): Applying a 'Value Landscapes
 1158 Approach' to Conflicts in Water Governance: The Case of the Paraguay-Paraná Waterway, in:
 1159 *Ecological Economics*, vol. 138: 47-55.
- 1160 Schwartz, S.H. (1992): Universals in the Content and Structure of Values: Theoretical Advances and
 1161 Empirical Tests in 20 Countries, in: Zanna, M.P. (ed.): *Advances in Experimental Social Psychology*,
 1162 vol. 25, San Diego, USA: Academic Press, 1-65.
- 1163 Schwartz, S.H. (1994): Are There Universal Aspects in the Structure and Contents of Human Values?
 1164 in: *Journal of Social Issues*, vol. 50(4): 19-45.
- 1165 Schwartz, S. (2001): A Proposal for Measuring Value Orientations across Nations, in: European Social
 1166 Survey (ed.): *European Social Survey Core Questionnaire Development*, London, UK: City University
 1167 London, 259-319.

- 1168 Schwartz, S.H. & Bilsky, W. (1987): Toward a Universal Psychological Structure of Human Values, in:
1169 *Journal of Personality and Social Psychology*, vol. 53(3): 550-562.
- 1170 Schwartz, S.H. & Boehnke, K. (2004): Evaluating the structure of human values with confirmatory
1171 factor analysis, in: *Journal of Research in Personality*, vol. 38(3): 230-255.
- 1172 Schwartz, S.H., Cieciuch, J., Vecchione, M., Davidov, E., Fischer, R., Beierlein, C., Ramos, A.,
1173 Verkasalo, M., Lönnqvist, J., Demirutku, K., Dirilen-Gümüş, Ö., & Konty, M. (2012): Refining the
1174 Theory of Basic Individual Values, in: *Journal of Personality and Social Psychology*, vol. 103(4): 663-
1175 688.
- 1176 Seymour, E., Curtis, A., Pannell, D., Allan, C., & Roberts, A. (2010): Understanding the role of assigned
1177 values in natural resource management, in: *Australasian Journal of Environmental Management*, vol.
1178 17(3): 142-153.
- 1179 Seymour, E., Curtis, A., Pannell, D.J., Roberts, A., & Allan, C. (2011): Same river, different values and
1180 why it matters, in: *Ecological Management & Restoration*, vol. 12(3): 207-213.
- 1181 Sherrouse, B.C., Clement, J.M., & Semmens, D.J. (2011): A GIS application for assessing, mapping,
1182 and quantifying the social values of ecosystem services, in: *Applied Geography*, vol. 31(2): 748-760.
- 1183 Shin, Y.H., Moon, H., Jung, S.E., & Severt, K. (2017): The effect of environmental values and attitudes
1184 on consumer willingness to pay more for organic menus: A value-attitude-behavior approach, in:
1185 *Journal of Hospitality and Tourism Management*, vol. 33: 113-121.
- 1186 Sieber, R. (2006): Public Participation Geographic Information Systems: A Literature Review and
1187 Framework, in: *Annals of the Association of American Geographers*, vol. 96(3): 491-507.
- 1188 Siegmund-Schultze, M., Rodorff, V., Köppel, J., & do Carmo Sobral, M. (2015): Paternalism or
1189 participatory governance? Efforts and obstacles in implementing the Brazilian water policy in a large
1190 watershed, in: *Land Use Policy*, vol. 48: 120-130.
- 1191 Signor, R., Love, P.E.D., & Olatunji, O. (2016): Determining Overpricing in Brazilian Infrastructure
1192 Projects: A Forensic Approach, in: *Journal of Construction Engineering and Management*, vol. 142(9):
1193 06016001.
- 1194 Small, N., Munday, M., & Durance, I. (2017): The challenge of valuing ecosystem services that have
1195 no material benefits, in: *Global Environmental Change*, vol. 44: 57-67.
- 1196 Spangenberg, J.H. & Settele, J. (2010): Precisely incorrect? Monetising the value of ecosystem
1197 services, in: *Ecological Complexity*, vol. 7(3): 327-337.
- 1198 Spash, C.L. & Vatn, A. (2006): Transferring environmental value estimates: Issues and alternatives, in:
1199 *Ecological Economics*, vol. 60(2): 379-388.
- 1200 Springett, D. (2013): Editorial: Critical Perspectives on Sustainable Development, in: *Sustainable*
1201 *Development*, vol. 21(2): 73-82.
- 1202 Steg, L. (2016): Values, Norms, and Intrinsic Motivation to Act Proenvironmentally, in: *Annual Review*
1203 *of Environment and Resources*, vol. 41: 277-292.
- 1204 Steg, L. & de Groot, J.I.M. (2012): Environmental Values, in: Clayton, S.D. (ed.): *The Oxford Handbook*
1205 *of Environmental and Conservation Psychology*, New York, USA: Oxford University Press, 81-92.

- 1206 Steg, L., Bolderdijk, J.W., Keizer, K., & Perlaviciute, G. (2014): An Integrated Framework for
 1207 Encouraging Pro-environmental Behaviour: The role of values, situational factors and goals, in:
 1208 *Journal of Environmental Psychology*, vol. 38: 104-115.
- 1209 Steg, L., Perlaviciute, G., van der Werff, E., & Lurvink, J. (2014): The Significance of Hedonic Values
 1210 for Environmentally Relevant Attitudes, Preferences, and Actions, in: *Environment and Behavior*, vol.
 1211 46(2): 163-192.
- 1212 Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., & Kalof, L. (1999): A Value-Belief-Norm Theory of
 1213 Support for Social Movements: The Case of Environmentalism, in: *Human Ecology Review*, vol. 6(2):
 1214 81-97.
- 1215 Stern, P.C., Dietz, T., & Guagnano, G.A. (1998): A Brief Inventory of Values, in: *Educational and*
 1216 *Psychological Measurement*, vol. 58(6): 984-1001.
- 1217 Stern, P.C., Dietz, T., Kalof, L., & Guagnano, G.A. (1995): Values, Beliefs, and Proenvironmental
 1218 Action: Attitude Formation Toward Emergent Attitude Objects, in: *Journal of Applied Social*
 1219 *Psychology*, vol. 25(18): 1611-1636.
- 1220 Stevens, J.P. (2009): *Applied multivariate statistics for the social sciences*, 5th ed., New York, USA &
 1221 Hove, UK: Routledge.
- 1222 Tadaki, M., Sinner, J., & Chan, K.M.A. (2017): Making sense of environmental values: a typology of
 1223 concepts, in: *Ecology and Society*, vol. 22(1): 7.
- 1224 Tamayo, A. & Porto, J.B. (2009): Validação do Questionário de Perfis de Valores (QPV) no Brasil, in:
 1225 *Psicologia: Teoria e Pesquisa*, vol. 25(3): 369-376.
- 1226 Tang, J., Folmer, H., & Xue, J. (2015): Technical and allocative efficiency of irrigation water use in the
 1227 Guanzhong Plain, China, in: *Food Policy*, vol. 50: 43-52.
- 1228 Taylor, P.D., Fahrig, L., Henein, K., & Merriam, G. (1993): Connectivity is a vital element of landscape
 1229 structure, in: *Oikos*, vol. 68(3): 571-573.
- 1230 Toma, L., McVittie, A., Hubbard, C., & Stott, A.W. (2011): A Structural Equation Model of the Factors
 1231 Influencing British Consumers' Behaviour toward Animal Welfare, in: *Journal of Food Products*
 1232 *Marketing*, vol. 17(2-3): 261-278.
- 1233 Treib, O., Bähr, H., & Falkner, G. (2007): Modes of governance: towards a conceptual clarification, in:
 1234 *Journal of European Public Policy*, vol. 14(1): 1-20.
- 1235 Tsanga Tabi, M. & Verdon, D. (2015): Les valeurs ont-elles une place dans le management des
 1236 services publics ? Leçons d'une recherche-action, in: *Revue Française de Gestion*, vol. 250: 105-124.
- 1237 Turner, A.G. (2003): *Sampling Strategies*, ESA/STAT/AC.93/2, New York, USA: Statistics Division,
 1238 United Nations Secretariat.
- 1239 UFPR/ITTI = Universidade Federal do Paraná/Instituto Tecnológico de Transporte e Infraestrutura
 1240 (2016): *Hidrovia do Rio Paraguai: EVTEA – Estudo de Viabilidade Técnica, Econômica e Ambiental*,
 1241 Informativo, Edição Única, Curitiba, Brazil: UFPR/ITTI.
- 1242 van Leeuwen, C.J., Frijns, J., van Wezel, A., & van de Wen, F.H.M. (2012): City Blueprints: 24
 1243 Indicators to Assess the Sustainability of the Urban Water Cycle, in: *Water Resources Management*,
 1244 vol. 26: 2177-2197.

1245 van Meerkerk, I., Edelenbos, J., & Klijn, E.-H. (2015): Connective management and governance
 1246 network performance: the mediating role of throughput legitimacy. Findings from survey research
 1247 on complex water projects in the Netherlands, in: *Environment and Planning C: Government and*
 1248 *Policy*, vol. 33: 746-764.

1249 Van Riper, C.J. & Kyle, G.T. (2014): Capturing multiple values of ecosystem services shaped by
 1250 environmental worldviews: A spatial analysis, in: *Journal of Environmental Management*, vol. 145:
 1251 374-384.

1252 van Schie, N., Duijn, M., & Edelenbos, J. (2011): Co-valuation: Exploring methods for expert and
 1253 stakeholder valuation, in: *Journal of Environmental Assessment Policy and Management*, vol. 13(4):
 1254 619-650.

1255 Vaske, J.J. & Donnelly, M.P. (1999): A Value-Attitude-Behavior Model Predicting Wildland
 1256 Preservation Voting Intentions, in: *Society & Natural Resources*, vol. 12(6): 523-537.

1257 Winter, B. (2017): Brazil's never-ending corruption crisis: Why radical transparency is the only fix, in:
 1258 *Foreign Affairs*, vol. 96(3): 87-94.

1259 Xepapadeas, A. & Stefan, J. (2014): Introduction: 20 years later, in: *Environment and Development*
 1260 *Economics*, vol. 19(3): 271-284.

1261 Yazdanpanah, M., Hayati, D., Hochrainer-Stigler, S., & Zamani, G.H. (2014): Understanding farmers'
 1262 intention and behavior regarding water conservation in the Middle-East and North Africa: A case
 1263 study in Iran, in: *Journal of Environmental Management*, vol. 135: 63-72.

1264 Young, H.P. (1994): *Equity: In Theory and Practice*, Princeton, USA: Princeton University Press.

1265 Zhao, X., Lynch Jr., J.G., & Chen, Q. (2010): Reconsidering Baron and Kenny: Myths and Truths about
 1266 Mediation Analysis, in: *Journal of Consumer Research*, vol. 37(2): 197-206.

1267 Zhou, A. (2010): "Adverse Forces" in the Brazilian Amazon: Developmentalism Versus
 1268 Environmentalism and Indigenous Rights, in: *The Journal of Environment & Development*, vol. 19(3):
 1269 252-273.

1270

1271 **Appendix A**

1272 *Table 3: Pearson χ^2 test of difference – Sample vs Upper Paraguay River Basin to evaluate sample representativeness; ***
 1273 *Difference between sample and UPRB is significant at the .01 level (2-sided).*

Variable	χ^2	Degrees of freedom (df)	p-value
Location	0.799	1	0.371
Gender	1.672	1	0.196
Age	6.408	12	0.894
Household size	1.839	5	0.871
Formal education	4.405	3	0.221
Occupational status**	7.133	1	0.008
Monthly household income	9.112	5	0.105

1274

1275 **Appendix B**

Table 4: A structural equation model of value landscapes and their effect on water policy preferences.

N (used)	χ^2	df (degrees of freedom)	P-value (χ^2)	CFI	TLI	RMSEA	90% conf. int. (RMSEA)	SRMR
1028	464.808	153	.000	.966	.958	.044	.039, .048	.057
LATENT VARIABLES								
Latent variable	Item/indicator	Estimate	Std. err.	z-value	P(> z)	Std. est.		
Self-transcendence	universalism 1	1 (fixed)				.597		
	universalism 2	.964	.056	17.305	.000	.575		
	universalism 3	1.224	.062	19.735	.000	.731		
	benevolence 1	1.220	.061	19.928	.000	.728		
	benevolence 2	1.213	.060	20.198	.000	.724		
Self-enhancement	achievement 1	1 (fixed)				.559		
	achievement 2	1.137	.065	17.475	.000	.636		
	hedonism 1	1.205	.072	16.831	.000	.674		
	hedonism 2	1.031	.064	16.140	.000	.576		
Democratic governance	democratic legitimacy	1 (fixed)				.636		
	social justice	1.176	.107	11.043	.000	.748		
Economic governance	economic efficiency	1 (fixed)				.572		
	rule of law/order	.832	.107	7.800	.000	.476		
Cultural water values	traditional lifestyles	1 (fixed)				.652		
	traditional festivities	1.026	.086	11.908	.000	.670		
Economic water values	agriculture	1 (fixed)				.655		
	hydroelectric power	.871	.107	8.148	.000	.570		
Ecological water values	Pantanal's nature	1 (fixed)				.800		
	wildlife	.885	.098	9.070	.000	.708		
REGRESSION PATHS								
Dependent variable	Independent variable	Estimate	Std. err.	z-value	P(> z)	Std. est.		
Democratic governance	Self-transcendence	.353	.053	6.603	.000	.331		
Economic governance	Self-enhancement	.234	.076	3.089	.002	.229		
Ecological water values	Self-transcendence	.555	.078	7.123	.000	.414		
Economic water values	Self-enhancement	-.053	.080	-0.664	.506	-.046		
	Economic governance	.694	.103	6.711	.000	.606		
Cultural water values	Democratic governance	.504	.072	6.933	.000	.491		
Paraguay-Paraná	Self-transcendence	-.230	.237	-.968	.333	-.137		
Waterway	Self-enhancement	.483	.211	2.290	.022	.270		

policy preference	Democratic governance	.631	.560	1.127	.260	.401
	Economic governance	-1.178	.701	-1.679	.093	-.674
	Cultural water values	.026	.248	.105	.916	.017
	Economic water values	.485	.262	1.849	.064	.318
	Ecological water values	-.367	.157	-2.343	.019	-.294

COVARIANCE

Latent variable 1	Latent variable 2	Estimate	Std. err.	z-value	P(> z)	Std. est.
Self-transcendence	Self-enhancement	.200	.015	13.079	.000	.598

RESIDUAL COVARIANCES

Latent variable 1	Latent variable 2	Estimate	Std. err.	z-value	P(> z)	Std. est.
Democratic governance	Economic governance	.278	.032	8.696	.000	.834
Cultural water values	Economic water values	.161	.028	5.809	.000	.539
	Ecological water values	.277	.032	8.586	.000	.669
Economic water values	Ecological water values	.150	.031	4.772	.000	.391

1277

1278