

# Legislation for wetland conservation in Brazil: Are existing terms and definitions sufficient?

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## SUMMARY

Laws are crucial tools to protect wetlands. How these laws are written has important implications for conservation. We assessed all wetland terms and definitions in Brazilian legislation to identify whether legislation uses any generic terms to represent several or all types of wetlands and to determine if definitions with clear descriptors exist that can easily be used to identify wetland systems. A total of 116 local wetland-related terms and 21 wetland definitions were found in Brazilian legislation. A direct Portuguese translation of the term ‘wetlands’ was found only once in the New Forest Code. The insertion of the term ‘wetlands’ in the New Forest Code has important practical implications for the conservation, since all different Brazilian wetland types would be represented by the generic term ‘wetlands’. The existence of a definition of the term ‘wetlands’ associated with attributes of water and biota in Federal legislation will help environmental technicians to identify wetland systems and to recognize different wetland types. The insertion of this definition in the New Forest Code would make it clear that the drainage of any wetland type – large or small – is prohibited, and those who do so would be breaking Brazilian environmental law.

*Keywords:* biodiversity, laws, water resources, wetland definition, wetland policy

## INTRODUCTION

Laws and legal statutes are crucial tools to protect and conserve wetland habitats. How these laws are written has important implications for wetland conservation. As such, the terminology used to legally identify and define wetland habitats is important because it can facilitate the identification of different types of wetlands. Internationally, the most widely used definition of ‘wetlands’ was proposed at the 1971 Ramsar Convention: ‘areas of marsh, fen, peatland or water, whether

natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.’ This definition clearly identifies three wetland types (marsh, fen and peatland), but these types are not present in many of the world’s countries. In addition, this definition does not use clear descriptors that help in the accurate identification of wetlands (such as the presence of saturated soil or aquatic vegetation).

Definitions with clear descriptors enable scientists and planners to classify a habitat as being a wetland. In the United States, the term ‘wetlands’ has a fairly narrow definition: ‘those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils’ (US EPA 2017). Because US legislation uses ‘wetlands’ as a generic term with clear descriptors to identify a wetland system (in this case water presence, aquatic vegetation and hydric soils), considerable efforts have been made to determine what is and what is not a wetland. However, this specificity does not apply to many countries. Thus, legislation to protect and regulate wetlands often uses regional terms and related definitions sometimes use non-scientific descriptors, generating confusion among environmental managers trying to identify habitats as wetlands. Understanding terminologies and definitions regarding wetland habitats in legislation is an important first step for evaluating the efficacy of existing wetland legislation.

In South America, *c.* 50% of the total wetland area occurs in Brazil (Naranjo 1995), making the country a focal point for aquatic biodiversity throughout the continent and the neotropical region in general (Lewinsohn & Prado 2002; Chambers *et al.* 2008). Wetland loss rates in Brazil are largely unknown. Maltchik *et al.* (2003a, 2003b) estimated that *c.* 90% of the wetlands in southern Brazil are already fragmented. The main causes of wetland loss in Brazil are agricultural and urban expansion, pollution, drainage for cattle grazing and pine invasion. In order to advance legal protection for wetlands in Brazil, it would be useful to better understand how the country defines wetlands in their legislation. To this end, the main goal of this study was to assess all wetland terms and definitions in current Brazilian legislation and how they vary

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**Table 1** Number of wetland terms and definitions observed in two ambits of Brazilian legislation: federal and state. Totals are less than the summations of individual entries due to the overlap of some terms across multiple categories. CONAMA = Conselho Nacional do Meio Ambiente.

	Federal ambit				Total	State ambit		Total
	New Forest Code (2012)	Forest Code (1965)	CONAMA 302 (2002)	CONAMA 303 (2002)		Constitutions	Ordinary laws	
Terms	25	10	4	20	35	75	63	111
Definitions	10	0	1	4	11	0	14	14

across different hierarchies: federal and state. We identified whether Brazilian legislation used any generic terms that represent several types of wetlands and if definitions with clear descriptors exist that can easily be used to identify wetland systems. We believe that these results could help wetland conservation programmes in Brazil, where the ongoing loss of wetlands and their biodiversity remains a serious problem.

## METHODS

### Quantitative survey of Brazilian legislation

The federal constitution is the highest legal standard of the Federative Republic of Brazil; below it are federal laws, state constitutions, state ordinary laws (state level) and municipal laws (county level). Our survey addressed legislation at both federal and state levels. In the federal ambit, we surveyed two federal laws (the Brazilian Forest Code of 1965 and the New Brazilian Forest Code of May of 2012 (Law 12.651/2012)). We analysed two National Resolutions of Conselho Nacional do Meio Ambiente (CONAMA; National Council on the Environment) (resolutions of CONAMA 303 and 302 from 2002) of the federal ambit. In the state ambit, we analysed the constitutions and ordinary environmental laws of all 26 Brazilian states distributed over the five official Brazilian regions (North, Northeast, Centre-West, Southeast and South).

The Brazilian Federal Code of 1965 (Law 4.771 from 25 September 1965) gathered into a single federal law the norms of Brazilian environmental law related to the protection of the country's vegetation. The Brazilian Forest Code of 1965 was then replaced by a new federal law, the New Forest Code of 2012 (Law 12.651 from 25 March 2012) that currently is in effect. The Brazilian Forest Codes are federal laws establishing the general rules about where and how the Brazilian territory can be exploited, determining which vegetated areas should be preserved and which areas are permitted to be economically exploited by human activities. The two resolutions of CONAMA surveyed in our study (number 303 from 2002 and number 302 from 2002) are federal administrative acts with legal implications for environmental themes across the Brazilian territory. The state constitutions analysed are laws establishing the general rules of each state of the Federation, including for the environment. Ordinary environmental laws are Brazilian state laws approved by

a simple majority of state legislators. Federal laws and resolutions take precedence over state constitutions and ordinary laws; state legislation cannot be contrary to the rules of federal law.

Our research was conducted using official internet sites and documents belonging to state governments and secretaries of state for the environment. The New Forest Code (2012), the Forest Code (1965) and the two resolutions of CONAMA (2002) came from the Environmental Laws Collection (Medauar 2007, 2015). The state constitutions and the state ordinary laws had been developed by individual states or regions (North, Northeast, Centre-West, Southeast and South).

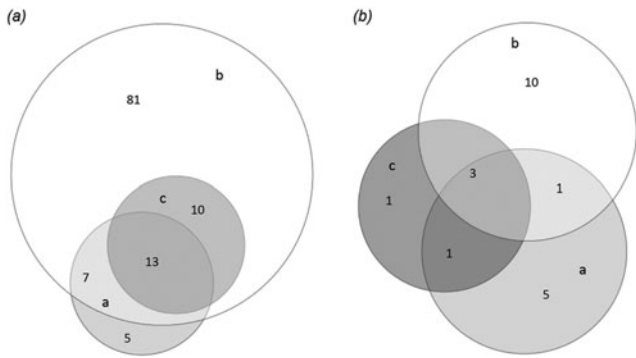
The selected laws were each read carefully three times by two researchers (for a total of six examinations) to minimize error in the search for the total number of wetland terms. All definitions of wetlands found in the Brazilian laws and resolutions were assessed, searching for clear descriptors that could easily identify a wetland system, such as the presence of hydric soils or biota adapted for life in water or in saturated soil (Cowardin *et al.* 1979). In addition, we analysed the definitions of all wetland terms found in the Brazilian legislations using a Brazilian ecological glossary (ACIESP 1997) and a widely used Brazilian dictionary (Ferreira 2004).

Venn diagrams with three sets were generated to show the number of terms and definitions unique to each legislative level, how much overlap in terminology existed and the number the terms and definitions that were introduced. The three sets corresponded to: (1) the New Forest Code; (2) other federal legislations (the Forest Code, CONAMA 302 and CONAMA 303); and (3) state legislations (constitutions and ordinary laws). Venn diagrams were created using eulerAPE software version 3 (Micallef & Rodgers 2014).

## RESULTS

A total of 116 local wetland-related terms were found in Brazilian legislation across two ambits: federal and state (Table 1). The state constitutions contained the largest number of wetland-related terms (75), followed by the state ordinary laws (63) and federal laws and national resolutions (35) (Table 1).

Direct Portuguese translations of the term 'wetlands', such as 'áreas úmidas' (áreas = land, úmidas = wet), were found only in the current New Forest Code. Several representative



**Figure 1** Venn diagrams comparing the number of (a) terms and their overlap between the New Forest Code, other federal legislations and state legislations and (b) definitions and their overlap between the New Forest Code, other federal legislations and state legislations. a = New Forest Code. b = State legislations (constitutions and ordinary laws). c = Other federal legislations (Forest Code, CONAMA 302 and CONAMA 303).

**Table 2** Number of wetland terms observed in Brazilian state legislation (constitutions and ordinary laws) per Brazilian region (N = North; NE = Northeastern; CW = Centre-West; SE = Southeastern; S = South).

State legislation	Brazilian regions				
	N	NE	CW	SE	S
Constitutions	19	49	16	28	5
Ordinary laws	20	43	14	22	29
Total	39	92	30	40	34

Brazilian wetland types, such as swamps, mangroves, lakes, ponds, springs and streams, also were observed in the New Forest Code. Three terms covered man-made ecosystems (dammed watercourses, water reservoirs and artificial water bodies) in the federal ambit. The New Forest Code had the largest number of wetland terms in a single statute (25) (Table 1) and it introduced 12 new wetland terms into the national ambit (federal law and resolutions). However, only five of these terms (hydric resources, Pantanal, surface water, vazantes and wetlands) were added for the first time to Brazilian legislation (Fig. 1(a)). The New Forest Code modestly reduced the overlap of terms between federal and state legislations (Fig. 1(a)).

Overall, the greatest numbers of wetland terms were found across the 26 state constitutions, with most of them being found in the Northeast region (Table 2). A direct equivalent to the term ‘wetlands’ was not found in any state constitution. Terminology in state constitutions primarily identified wetland habitats using local words. Of the total 63 wetland terms encountered in state ordinary laws, extensive variation of terms was found across the five Brazilian regions (Table 2). The states with the largest Brazilian wetlands (‘Pantanal wetlands’ in Mato Grosso State – Centre-West region; and ‘varzea’ and ‘igapos’ wetlands in Amazon State – North region) had a higher number of wetland terms in their

state legislation. The term ‘wetlands’ was again not found in any state ordinary law.

Only 21 of the 116 wetland-related terms listed across all Brazilian legislation were specifically defined by legislators (11 terms are in federal laws and national resolutions, 14 terms are in state ordinary laws and four terms are shared by both legislation types) (Table 1). The New Forest Code had the largest number of wetland definitions in the federal ambit (10) and it introduced five new definitions of wetland terms to Brazilian legislation (flooding area, flooding varzea, floodplain, regular channel and wetlands) (Fig. 1(b)). The New Forest Code reduced the overlap of definitions between federal and state legislations (Fig. 1(b)). Of the 116 wetland terms found across all Brazilian legislation, 115 terms were defined, at least in part, by a major Brazilian dictionary (Ferreira 2004) and 20 terms were defined by an ecological glossary (ACIESP 1997). Most of the wetland definitions in the Brazilian legislation were vague because they lacked clear descriptors to identify wetland systems such as hydrology, hydric soils or the occurrence of biota adapted for life in water. We found only four definitions in Brazilian legislation that included attributes of water or biota in their descriptions (Table 3): three in federal legislation and one in state legislation. The best definition that we have found in the Brazilian legislation was the definition of the generic term for ‘wetlands’ included in the New Forest Code. This definition was associated with attributes of water and biota (‘areas periodically covered by water, originally covered by forests or other forms of vegetation adapted to the flood’) (Table 3). The other three definitions were not associated with a generic term such as ‘wetlands’, but instead associated with a term for a specific wetland type (e.g. mangroves) or with terms that lacked nationwide application (veredas or banhados) (Table 3).

## DISCUSSION

The high number of wetland terms observed in Brazilian legislation may be related to the large size of Brazil and to its substantial environmental and geomorphological variability (climate, topography, soil and vegetation). The largest number of wetland terms was observed in state legislation probably because state legislators are acquainted with the locally used wetland terms. Variation among Brazilian regions may have occurred either because some regions had more wetlands or because some state legislators exhibit more concern for the conservation of locally important wetlands. State legislation in the Northeast region had more than twice the number of wetland-related terms than any other Brazilian region. The granted protections to local wetland areas in the Northeast region may be related to the relatively low precipitation in the region (400 mm per year), making wetlands important sources of water to the local population.

The New Forest Code of 2012 added five new wetland terms to the overall Brazilian legislation. This number seems low, especially because the New Forest Code was designed

**Table 3** Wetland terms and their respective definitions in Brazilian legislation that included attributes of water, biota or hydric soil in their descriptions. CONAMA = Conselho Nacional do Meio Ambiente.

<i>Wetland term</i>	<i>Legislation</i>	<i>Definition</i>
'Banhado' (local term without an adequate English translation)	State – Rio Grande do Sul	'Expanses of land usually saturated with water where typical fauna and flora can grow and develop'
'Mangroves'	Federal CONAMA 303/2002	'Coastal ecosystem that occurs in low lands, subject to tidal action and associated predominantly to natural vegetation known as mangrove, with fluvial–marine influence'
'Veredas' (local term without an adequate English translation)	Federal CONAMA 303/2002	'... local that contains springs and headwaters of watercourses, where there is occurrence of hydromorphic soils, characterized predominantly by typical vegetation, such as buritis ( <i>Mauritia flexuosa</i> ) and others typical vegetation species'
'Wetlands' (included in the New Forest Code by supplementary law of October 2012 (12.727/2012))	Federal New Forest Code	'... areas periodically covered by water, originally covered by forests or other forms of vegetation adapted to the flood'

to replace a code produced 50 years ago. The five new wetland terms in the New Forest Code modestly reduced the overlap of terms between federal and state legislations. This reduction was a positive trend because the vast majority of the terms introduced were not regional, but rather were generally representative across the country. Of the five terms introduced, only one had only regional relevance. However, the introduction of the regional term 'Pantanal' in federal legislation was appropriate since it protects one of the Brazilian wetlands of greatest biodiversity and size at the federal level. Additionally, in terms of conservation, the low number of new terms introduced is not problematic because of the introduction in the New Forest Code of a generic term for 'wetlands' (i.e. 'áreas úmidas', which is the translation into Portuguese of the term 'wetlands'). This was an important step forwards for conservation of Brazilian wetland biodiversity. The term for generic 'wetlands' introduced in the New Forest Code now should represent all different wetland types across the entirety of Brazil, making most of the regional wetland terms used across all other Brazilian legislation redundant. The insertion of the term 'wetlands' into the New Forest Code has important practical implications for the conservation of these ecosystems, since all different Brazilian wetland types would be represented by the same term and thus they all would be protected by law.

Of the 116 wetland terms mentioned in Brazilian legislation, 21 were also defined in the statutes. The five new wetland definitions in the New Forest Code also reduced the overlap of definitions between federal and state legislations. This reduction was positive because the new definitions introduced in the New Forest Code were from terms of greater representativeness throughout the country. Only four wetland terms were defined using clear descriptors (such as water and biota adapted for life in water). The terms 'mangroves', 'veredas' and 'wetlands' were defined in federal legislation and the term 'banhados' was defined in a state ordinary law. In terms of conservation, these four definitions were probably

the most useful ones observed in Brazilian legislation because they used clear descriptors to identify wetland systems. These definitions shared characteristics of definitions of wetlands proposed for Australia (Paijmans *et al.* 1985), Canada (Zoltai *et al.* 1975), the USA (Cowardin *et al.* 1979) and recently by Brazilian researchers (Junk *et al.* 2014). However, three of the four definitions had limitations for the conservation of wetlands nationwide. The term 'banhado' is a term that is relevant only in one Brazilian region and its use is restricted to the extreme south of Brazil. This definition was also present only in the state ordinary law; that is, it has no application to the 25 other Brazilian states analysed. The term 'mangrove' is widely used nationally, but any wetland protection is restricted to one specific wetland type in Brazil. The term 'veredas' also occurs in a federal law, but this term is very local and it is not used across much of the country.

However, the definition of the generic term 'wetlands' in the New Forest Code using clear descriptors confers importance in terms of policy. Federal law is hierarchically superior to state constitutions and ordinary laws and this definition should prevail over all other definitions of wetlands in Brazilian legislation. Of the ten new wetland definitions introduced in the New Forest Code, the definition of a generic term 'wetlands' was the most important in terms of conservation. The existence of this definition in the New Forest Code will help workers and planners to more easily identify any wetland type throughout the country and consequently provide broad protections to wetland systems. This definition makes it clear that any land flooded by water where aquatic plants have developed, including trees, is a wetland and must be protected by law. This definition protects all types of wetlands, regardless of their size, number of species, habitat diversity or any other wetland attribute.

The definition based on these attributes will help environmental technicians and decision-makers to identify wetland systems and recognize different wetland types. The possibility of error in what is or is not a wetland decreases

when definitions are linked to environmental descriptors that are easily observed in the field. This definition in the New Forest Code would make it clear that the drainage of any wetland type – large or small – is prohibited, and those who do so would be breaking Brazilian environmental law.

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#### CONFLICT OF INTEREST

None.

#### ETHICAL STANDARDS

None.

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