

Original Research Article

Spaces of environmental conflicts in the buffer zones for the protected area of the State Park Mata do Pau Ferro in Areia – Paraíba

ABSTRACT:

The National System of Conservation Units has defined a buffer zone as an area around a Conservation Unit, where activities must be subject to specific standards, in order to minimize negative impacts on ecosystems. Based on this discussion, this research uses remote sensing and geoprocessing and has as objectives: to map the use and occupation of the land, to simulate the buffer zone and to characterize the spaces of social and environmental conflicts of the State Park Mata do Pau Ferro, Areia-PB. Through the mapping of use and occupation was identified that the Park has 600 ha. Of these, 492 ha (82%) present a spectral response of forest vegetation (Seasonal Semideciduous Forest) in different successional stages, 54 ha (9%) represent clearings, with pioneer vegetation (Poaceaea and shrub), which present the same response spectral of crops and pastures, and 54 ha (9%) is the Vaca Brava reservoir, which presents its Permanent Preservation Area. The spaces of conflict are the protagonists of the buffer zone and summed represent 600 ha or 75% of the area. This fact can be considered an aggravating factor because all these economic activities are not being monitored and spatially symbolize a high degree of edge effect. Integrated management between the Conservation Unit and its buffer zone in this situation is urgent and should involve the surrounding social sectors, especially rural producers. An alternative would be the payment for Environmental Services and incorporate the agroforestry system.

Keywords: Protected Area; GIS; Forest Fragmentation.

1- INTRODUCTION

Conservation Units (UC) are areas delimited by public power of high environmental importance under protection. It can be Biological Reserves, Ecological Reserves, Ecological Stations, National, State and Municipal Parks, National, State and Municipal Forests, Environmental Protection Areas, Areas of Relevant Ecological Interest and Extractive Reserves (Mixe et al. ., 2017). Among the management and protection mechanisms of the UC's biodiversity are the Management Plan, buffer zone or buffer zone and ecological corridors.

The Management Plan represents the technical document that, based on the general objectives of a conservation unit, establishes its zoning and the norms that should govern the use of the area and the management of natural resources, including the establishment of structures necessary for the management of the unit (SNUC, 2000).

The buffer zones are peripheral delimitations that go beyond the political boundaries of the UC, seeking ecological stability. However, ecological corridors seek to mitigate the effects of fragmentation and insularization of natural environments, which hinder or even prevent the maintenance of biodiversity due to the isolation of ecosystems, through non-connectivity of the fragments (SNUC, 2000).

Milaré (2007) corroborates this discussion and points out that:

The buffer zone is not part of the conservation unit, but, under the law, it is subject to a kind of mandatory zoning, by which certain economic activities are permitted or regulated. As a matter of private property, as a general rule, no compensation is payable, since the affected property does not see its altered dominance and continues to accept economic uses, only under certain restrictions and regulation of activity, and, of course, in a manner not restrictive as it happens inside the units of conservation. However, limitations can not impair the right to property and its exercise, otherwise, it will entail administrative overlap with the consequent obligation to indemnify the Public Authorities (677).

The boundaries of UC are the most sensitive areas for degrading actions (Foreman and Gronton 1986), since they, directly and indirectly, influence the interior of the reserve because they cause "edge effects" (RIBEIRO et al., 2010; MACHADO et al., 2017).

Edge effects can be divided into direct and indirect physical and biological effects. Physical effects involve changes in environmental climatic factors, such as the formation of a warmer surrounding microclimate. Direct biological effects involve changes resulting from physical effects such as, for example, dominant colonization of adapted species, increased solar radiation; the indirect ones involve changes in the ecological interactions of the species, such as predation, parasitism, herbivory, competition, seed dispersal and pollination (RODRIGUES, 1993). Among the elementary authors of this discussion are: Bierregaard, et al. (1992), Campos & Agostinho (1997); Primack & Rodrigues (2001) and Ribeiro et al. (2010). This research has the following objectives: to map the use and occupation of the land, to simulate the buffer zone, to characterize and discuss the socio-environmental conflicts spaces of Mata do Pau Ferro State Park, Areia-PB.

The legal evolution of the buffer zone

Federal Law No. 5,197 of 1967, which deals with the protection of fauna, was the first legal approximation of the understanding of what had become buffer zones, when it dealt with protection in official establishments and dams in the public domain, emphasizing also the protection of "adjacent lands", up to the distance of five kilometers "(BRAZIL, 1967). Later, Federal Law No. 6,902 of 1979, which deals with the creation of Ecological Stations and Environmental Protection Areas, established that "neighbouring areas" of Ecological Stations should also be monitored for the protection of local biota (BRASIL, 1979). In 1990, Federal Decree No. 99,274, used the term

"surrounding areas" in UC to designate that adjacent perimeters should be monitored to avoid damages inside UCs (BRASIL, 1990).

In spite of different nomenclatures all these devices extolled the buffer zone, but it was the National System of Conservation Units, through CONAMA Resolution No. 13 of 1990, which first used the term "buffers zones" and defined that this environment should have a radius of up to 10 km adjustable by the Management Plan, Ecological / Economic Zoning or Master Plan of the areas and according to the management categories (BRAZIL, 1990).

This standard and unique 10-km adjustment for all COs remained in force until the creation of the National System of Conservation Units (SNUC), Law No. 9,985 of 2000, which repealed the previous Resolution (CONAMA No. 13/90) and (Federal, State or Municipal) to regulate the occupation and use of resources in buffer zones. In addition, the limits were established at the time of the creation of the CU or later, being the most common after creation and according to what was determined in the Management Plan (BRASIL, 2000)

In 2010, under CONANA Resolution No. 428, it becomes mandatory to license the peripheral enterprises to UC by the managing bodies. In addition, these ventures were divided into two groups evaluated in the Environmental Impact Study (EIA) and Environmental Impact Report (RIMA). First, the "EIA / RIMA exempted ventures", which indicate low impact, "significant environmental impact", which symbolize a high degree of impact (BRAZIL, 2010).

In addition, with this new understanding, it was defined that the buffer zones in UCs that had not yet had a Management Plan should have 3 km in cases of the occurrence of ventures of significant environmental impact contained in the EIA / RIMA; already in cases of environmental licensing of projects not subject to EIA / RIMA, the perimeter became 2 km (BRAZIL, 2000).

In the same resolution, it was published that the bodies responsible for the administration of the PAs have a term of five years (2010-2015), counted from the publication of the resolution, to construct the Management Plans, and after this period, if it persists without the plan, the zone of buffer does not exist due to the environmental licensing obligation of the surrounding areas.

In this understanding, after 2015, only the buffer zone established with its Management Plan will be consulted for the environmental licensing of some projects. In cases of buffer zones without the Plan, the environmental licensing body should only inform the body responsible for managing the UC (BRASIL, 2000).

In this discussion, it is worth emphasizing that consulting and giving science, are different mechanisms. When consulting, ask for permission to insert something conferring the possibility of the manifestation of opinion, and when giving science, the insertion is informed. Thus, UC without the defined buffer zone, that is, without Management Plan, lost the purpose of protection of edge effects in the function of the devices of environmental licensing of the ventures. These findings corroborate with the understanding of Guimarães et al. (2012) and Costa et al. (2013).

In the state of Paraíba, there are seventeen state and none of the State's Management Plan or buffer zone (BARBOSA et al., 2017), which may constitute negligence and administrative

impropriety due to non-compliance with article 24 of the Federal Constitution, which deals with state jurisdiction to legislate on environmental issues.

Machado (2011), Granziera (2011), Antunes (2012) discuss that in addition to legislating on the environmental agenda, it is the state's duty to confer the Management Plan, demarcate the buffer zone of these CUs and create a preservation mechanism based on the indigenous characteristics of each area.

2- MATERIAL AND METHODS

2.1 Study area

The present research was carried out in the Mata do Pau-Ferro State Park, located in the city of Areia (Figure 1). The Municipality is located in the mesoregion of the Agreste and in the microregion of the Brejo Paraibano, Northeast of Brazil. It has an area of 269.4 km², an estimated population of 23,829,000 inhabitants and a population density of 88.42 hab./Km² (IBGE, 2015).

The Park is located in the southwest portion and is formed by 600 ha, under "As" tropical hot and humid (Köppen). The geology of the area is under the predominance of the morphostructural unit of the Paraíba Interplanaltic Depression of the Borborema Plateau, with captions of the Serra dos Martins Formation. The relief is submontana of flat tops, valleys, várzeas and areas dissected to the windward one. Soils vary from Oxisols to Argisols and Neosols. The hypsometry varies from 640 to 485m, within the sub-basin of the Brava sub-basin, with a predominance of wetlands of highland breeds and exposure (Semideciduous Seasonal Forest), from the biogeographic domain of the Atlantic Forest (MARQUES et al., 2014).

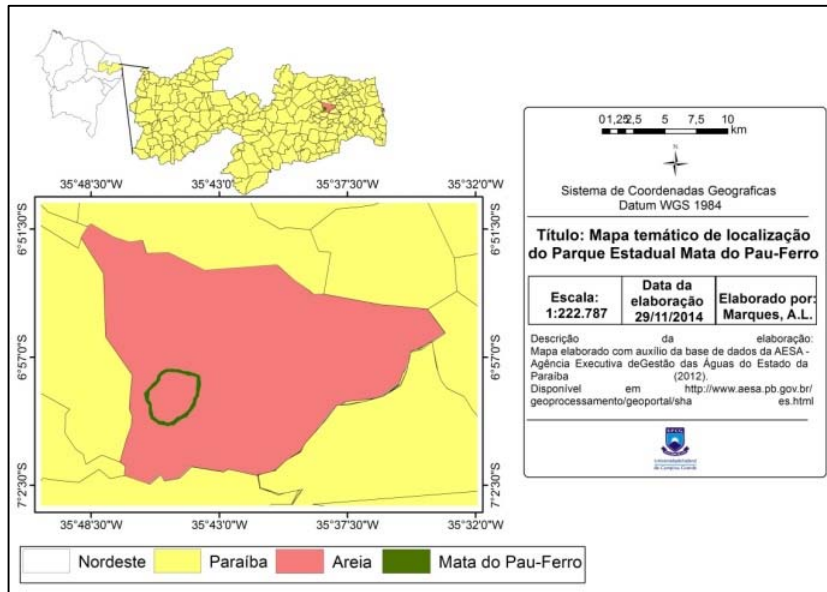


Figure 1: Location of the Mata do Pau-Ferro State Park, Areia-PB.

2.2 Use and occupation

The image (LC82140652014228LGN00) of the Landsat 8 sensor purchased from the US Geological Survey (USGS), dated August 16, 2014, from orbit 214, point 65 and composition of the 4R / 3G / 2B (natural) bands fused with the panchromatic band of spatial resolution of 15m. This included: datum adjustment for SIRGAS 2000, radiometric calibration (correction of imperfections) and reflectance computation (obtaining spectral responses) by the correction method of feignions and images of ArcGIS10.5 software.

With the support of the Land Use Technical Manual (IBGE, 2013) through the Maximum Likelihood (MAXVER) method in ArcGIS 10.5, spectral signatures were created from the classes of use and occupation: Cropland, Grassland, Forest Vegetation and Fluvial Waters. These classes were validated and corrected in the field and with support from other studies of the Linked Research Group.

2.2 Buffer Zone Simulation

The Mata do Pau Ferro State Park has no Management Plan and no buffer zone. The simulation of the buffer zone with (1) km of marginal stratification of the ArcGIS 10.5 buffer method, reproduced the parameters contemplated in Vio (2001) and reproduced by Barbosa (2016), Neri et al. (2016) and Barbosa et al. (2017) when they analyzed the same CU.

2.3 Characterization of social-environmental conflict spaces

The characterization of the spaces of socio-environmental conflicts was found in Bierregaard, et al. (1992), Campos & Agostinho (1997), Primack & Rodrigues (2001) and Ribeiro et al. (2010) and used cross-references of georeferenced data as shapefiles of the IBGE digital platform, such as demographic density, population and rural dwellings, activities and production in rural areas, agricultural census and Rural Environmental Cadastre.

With the help of geoprocessing in ArcGIS 10.5, different environments of use and occupation were identified and the conflict spaces were identified: Diversified crops, Monoculture crops, pastures / fallow / bare soil, forest vegetation and water. Photographic cutouts were also made in each impact space.

ArcGIS 10.5 software is licensed to the Multi-user Laboratory of Information Technology Applied to Human Sciences (LabINFO), Digital Cartography, Geoprocessing and Remote Sensing (CADIGEOS), Postgraduate Courses at the Humanities Center of the Federal University of Campina Great.

3- RESULTS AND DISCUSSION

3.1 The Conservation Unit and the buffer zone

The Pau Ferro forest is the only UHE of altitude swamps essentially of specimens of the Atlantic Forest in the state of Paraíba. In order to compare the flora of the Mata do Pau-Ferro with the flora of other northeastern highland forests, the floristic diversity of this PA was higher, which makes it important and important to preserve it (Barbosa et al., 2004).

Through the mapping of use and occupation was identified that the Park has 600 ha. Of these, 492 ha (82%) present a spectral response of forest vegetation (Seasonal Semideciduous Forest) in different successional stages, 54 ha (9%) represent clearings, with pioneer vegetation (Poaceaea and shrub), which present the same response spectral of crops and pastures, and 54 ha (9%) is the Vaca Brava reservoir, which presents its Permanent Preservation Area (Figure 2).

The clearings are the perturbation of the Park forest which is closely related to the degradation of the area (Barbosa et al., 2004, Silva et al., 2006, Marques et al., 2015), by the indigenous community, who practice agricultural activities, discard inorganic garbage, commit deforestation, and capture wild animals. The buffer zone is 800 ha and there are no ecological corridors. It is where they distribute farms, farms, farms and the districts of Muquem and Cepilho, as well as small communities such as Chã de Jardim, Vaca Brava and Sítio Macacos. These communities add up, a population contingent of approximately 3 thousand individuals, but there is no spatial configuration of a consolidated urban area.

The percentage of forest patches in the buffer zone is 200 ha or 25% and they are distributed in a perimeter disorder, with no spatial contact between these remnants and with the UC. This isolation is a critical factor in population dynamics, preventing species dispersal (METZGER, 1999). According to Bender et al. (1998) forest species in isolated fragments has their population progressively reduced by edge effects. However, although small and disjointed, these spots may harbour metapopulations and serve as ecological corridors or trampolines (Gherardi, 2007).

The low percentage of isolated forest patches identified was similar to that of studies also in the Semidecidual Seasonal Forest of buffer zones of the interior of São Paulo, reported by Cintra et al. (2006), Fushita (2010), Mello et al. (2014) and Moraes et al. (2015), evidencing the disordered use of land in the Atlantic Forest domain.

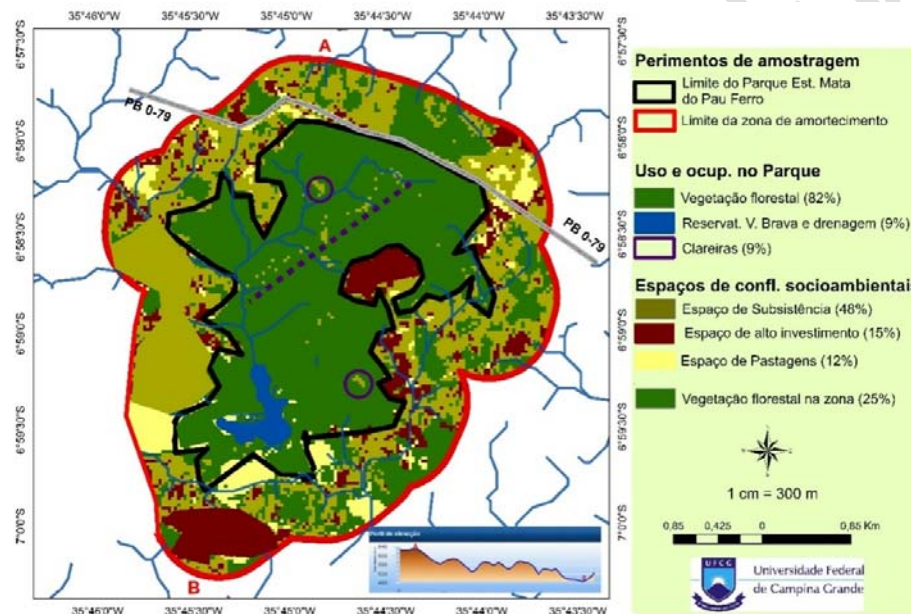


Figure 2: Land use and occupation, simulation of the buffer zone and impact spaces of Mata do Pau-Ferro State Park, Areia-PB.

3.2 The spaces of socio-environmental conflicts

The spaces of socio-environmental conflicts are the protagonists of the buffer zone. Together they represent 600 ha or 75% of the area (Figure 2), which is the same size in hectares of the Park. This fact can be considered an aggravating factor because all these economic activities are not being monitored and can symbolize a high degree of edge effects.

These spaces are representations of territorial distinctions as to the types of land uses that are linked to the types of management and investment values employed. They are territories where disastrous relationships involving man and nature intertwine in different spaces, and in this specific

situation, they attack UC. Thus, three spaces of socio-environmental conflicts were identified (Figure 2, Table 1).

Table 1: Economic activities of the impact spaces of the buffer zone of Mata do Pau-Ferro State Park, Areia-PB.

Spaces of social and environmental conflicts	Main economic activities	ha	%
Living Space	Planting beans (<i>Phaseolus vulgaris</i>), maize (<i>Zea mays</i>) and manioc (<i>Manihot esculenta</i>), Banana (<i>Musa sp.</i>) and extensive cattle raising	384	48
High investment space	Planting of sugar cane (<i>Saccharum officinarum</i>), milling units and investments in cultural tourism	120	15
Pasture space	<i>Brachiaria decumbens</i> and Elephant grass (<i>Pennisetum purpureum</i>) for livestock purposes	96	12

The first one received the nomenclature of Living Space (Figure 3), which presents 384 ha or 48% of the area, being configured mainly with various temporary crops (beans, maize and cassava), extensive cattle raising and fruit extractivism.

Beans, maize and cassava were the main crops identified in the buffer zone. The intercropping of these crops takes place in any topographical position of the landscape and there is the use of artesian wells and small dams built mainly in relief foothills.

This finding of this production corroborates with the data of the agricultural production of the city of Areia in 2015. This year the bean crop occupied 800 ha with a yield of 240 t, followed by maize with 400 ha and yield of 120 tea cassava with 240 ha and yield of 2,160 t. Being considered, the main crops of this regime in the municipality (IBGE, 2015).

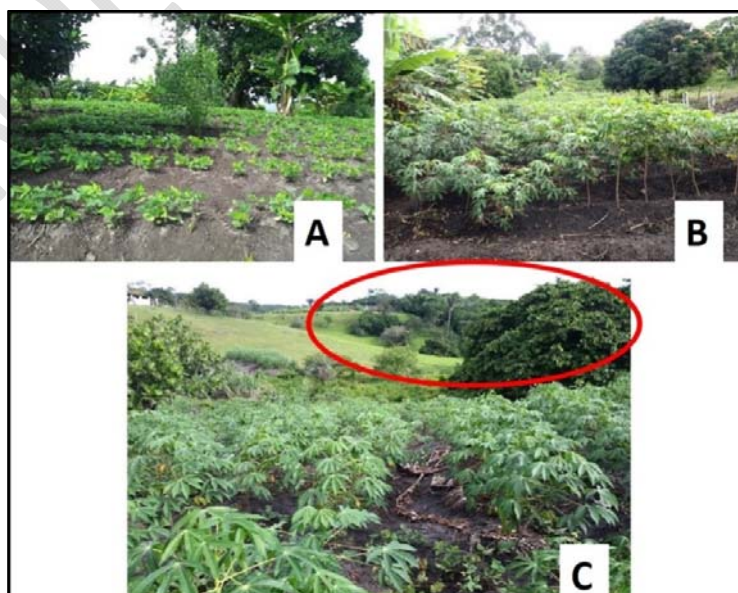


Figure 3: The aspects of Subsistence Area crops, with bean, corn, banana and cassava (A and B) planting, as well as a remnant of native forest pressed to the bottom sampled in red (C).

The second Space was called the Space of High Investments. It presents 120 ha or 15% of the zone (Figure 4), which is configured with sugarcane crops and its entire production chain. This planting occurs in the plateaus and shoulders of the landscape where Yellow Latossolos and Red-yellow Argisols prevail under a morphologically tabular surface (plateaus) originating from Serra dos Martins Formation, and also in the floodplain areas, where there is Gleissolos; excluding the position of slope and half slope, where the soils are shallower and is steeper.

The use of soil-routing machinery and fertilizer application are among the agricultural techniques used and can be leached into the water table, causing pollution of the entire micro basin of Vaca Brava. Sugarcane is the main monoculture of any buffer zone, and in 2015 was the most important monoculture of the municipality with 900 ha and 45,000 t, followed by banana with 800 ha and 960 t (IBGE, 2015).

Sugar cane exerts territoriality, which often enters the subsistence space, due to the practice of renting land. This is why it is the main commercial component of a chain of derivatives that mainly involve the manufacture of alembic cachaça. According to Braga and Kiyotani (2015), Paraíba is the second largest producer of this type of cachaça in Brazil, and the municipality of Areia is the state's largest producer with 29 mills. The Triunfo sugar mill, the largest producer in the municipality, charges 275,000 garrisons of the product per month.

For Moraes et al. (2014), the predominance of sugarcane monocultures poses a threat to the conservation of biodiversity, where environmental conflicts refer to surface and underground water contamination, from the release and release of tailings along the drainage, exhaustion of the soil by the use of chemical fertilization and mainly the burning of sugarcane, which releases carbon dioxide, ozone, nitrogen and sulfur gases, as well as the soot of the straw formed by the burning. In Figure 4, it is possible to observe aspects of sugarcane monoculture, under submontane relief, restricting the forest to a plateau (A and B), and structure of one of the plantations (C).

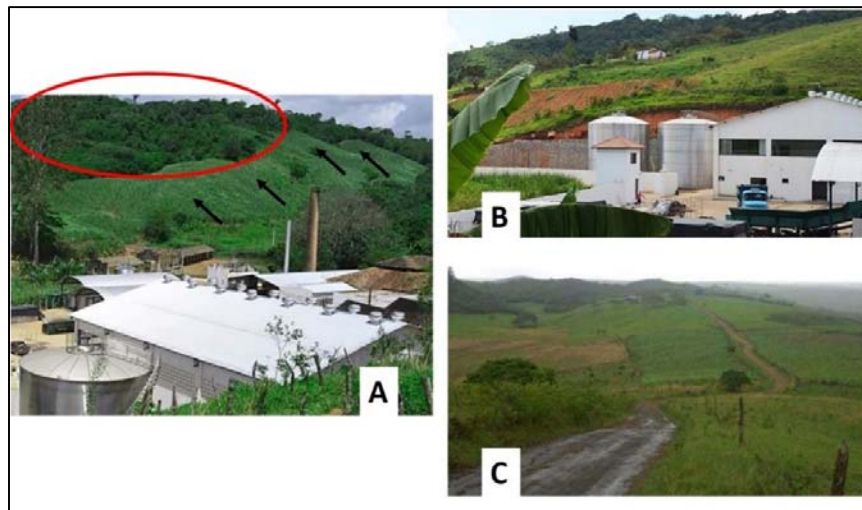


Figure 4: Aspects of the agrarian activities of the Space of High investments of the buffer zone of the State Park Mata do Pau Ferro, Areia-PB.

The third is Pasture Space. This covers intensive livestock farming with 96 ha or 12% of the area. Depending on the season of the year there will be pastures, such as grasses (in the rainy season), or will be fallow (in droughts), with species of herbaceous and successional pioneer, or will be with the surface horizon of the soil exposed or naked. One of the main problems of this area is the planting of pastures and cattle grazing in floodplain areas (Figure 5). Gleissolos are the main soils of this space, which is eventually thickened by cattle trampling.

The várzeas are hydromorphic ecosystems determined by the so-called "flood pulses" (LIMA et al., 2012). In the wetlands or English wetlands, in addition to the primary functions of watercourses for the storage, filtering and distribution of water along the drainage channels of the river basin (LIMA et al., 2012), its ciliary vegetation provides stability (WALTER et al., 2000). In addition, it is important to consider the effects of soil erosion and soil erosion on soil erosion and soil erosion (Naiman et al., 2000).

These pasture areas of this area are linked to cattle ranching in the municipality, which in 2015 had 12,028 heads, and of these, 1,202 were milking cows, which represented 865 thousand liters of milk (IBGE, 2015).



Figure 5: Aspects of the agrarian activities of the Area of Crops of the buffer zone of the Mata do Pau Ferro State Park, Areia-PB, with pastures (A and B) with the planting of various types of grasses, as well as a fallow land area indicated in yellow.

4- CONCLUSIONS

The lack of Management Plan of the State Park Mata do Pau Ferro has extolled a buffer zone, with different spaces of conflicts and territorial monopolies, in particular, the sugarcane crop that borders the UC.

There is a need for this plan, as set out in Agenda 21, National Water Resources Plan, Ecological and Economic Zoning, River Basin Plans and the Executive Plans, so that these different types of spaces can incorporate mechanisms for the conservation and interconnection of refuge biodiversity in the UC and in the isolated remnants of the buffer zone.

In all buffer zones there is fragmentation with remnants of forests, under pressure and in several successional stages, these areas are commonly deforested for agricultural use (fallow and crop rotation). The incorporation of ecological corridors with monitoring would allow the restoration of the Permanent Preservation Areas (floodplains) and recover with the native species the most sensitive areas, also providing the return of pollinating and dispersing species, which would help in the systemic environmental equilibrium of the PA.

Integrated management between UC and its buffer zone should involve the surrounding social sectors, especially rural producers. An alternative would be payment for Environmental Services (PSA).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

5- REFERENCES

Allen, R .; Tasumi, M .; Trezza, R. Sebal. Surface Energy Balance Algorithms for Land. Advanced Training and Users Manual - Idaho Implementation, v.1, 2002.

Antunes, P. de B. Environmental law. 14. ed. São Paulo: Atlas, 2012.

Barbosa, E.T.G. Use and occupation of the State Park Mata do Pau Ferro, Areia-PB and its potential for ecotourism activities: subsidy to geoconservation. Course Completion Work (Graduation in Geography) - Federal University of Campina Grande, 2016.

Barbosa, E.T.G .; Marques, A.L .; Ribeiro, J.K.N. Geoconservation in brejos of altitude: the State Park Mata do Pau-Ferro. NATURE AND CONSERVATION, 2017.

Barbosa, M.R.V .; Agra, M.F .; Sampaio, E.V.S.B .; Cunha, J.P. & Andrade, L.A FLORISTIC DIVERSITY OF MATA DO PAU FERRO, SAND, PARAÍBA. Pp. 111-122, In: K.C. Porto; J.J.P. Cabral & M. Tabarelli (eds.). Brejos de Altitude in Pernambuco and Paraíba: Natural History, ecology and conservation. Brasília, Ministry of the Environment. 2004.

Bierregaard, R.O .; Jr., T.E.L .; Kapos, V.A.A.S .; Hutchings, R. W. The biological dynamics of tropical rainforest fragments. *BioSciences*: 42: 859-866, 1992

Braga, M.V.F .; Kiyotani, I.B.A cachaça as patrimony: tourism culture and flavor. *Contemporary Tourism Magazine*. v. 3, p. 254-275, 2015.

Bender, D.J .; Contreras, T.A .; Fahrig, L. Habitat loss and population decline: ametaanalysis of patch size effect. *Ecology*, v.79, n.2, p.517-533, 1998.

BRAZIL. Federal Law n. 5,197, dated January 3, 1967. Establishes the Law on Protection of Wildlife. Available at: <http://www.planalto.gov.br/ccivil_03/Leis/L5197.htm>. Accessed on: ten. 2017.

Federal Decree n. 84,017, dated September 21, 1979. Regulates the Brazilian National Parks. Available at: <http://www.planalto.gov.br/ccivil_03/decreto/1970-1979/D84017.htm>. Accessed on: Feb. 2018.

Decree No. 99274/1990 - "Regulates Law No. 6,902, dated April 27, 1981, and Law No. 6.938, of August 31, 1981, which provide, respectively, for the creation of Ecological Stations and Environmental Protection Areas and for the National Policy of the Environment, and gives other measures. 2018.

Federal Law n. 9,985, dated July 18, 2000. Establishes the National System of Conservation Units of Nature - National System of Conservation Units (SNUC, 2000). Available at: <http://www.planalto.gov.br/ccivil_03/Leis/L9985.htm>. Access in: sea. 2018.

Cintra, R.H.S., Santos, J.R., Moschini, L.E .; Pires, J.S.R .; Henke-Oliveira, C. Qualitative and quantitative analysis of environmental damage throw instauration and register of lawful documents. *Archives of Biology and Technology*, v.49, n.6, p.989-999, 2006.

Campos, J.B .; Agostinho, A.A. Biodiversity flow corridor of the Paraná River: a proposal for the integration and environmental protection of threatened ecosystems. In: *Brazilian Congress of Conservation Units*, 1 .. Curitiba, PR, Anais ... Curitiba, p.645-657. 1997.

NATIONAL COUNCIL OF THE ENVIRONMENT - CONAMA. Resolution n. 13, dated December 6, 1990. Norms Regarding Surroundings Areas. Available at: <http://www.cetesb.sp.gov.br/licenciamentoo/legislacao/federal/resolucoes/1990_Res_CONAMA_13.pdf>. Access in: jan. 2018.

Costa, D.R.T.R .; Botezelli, L .; Silva, B.G .; Farias, O.L.M. Cushioning Areas in Conservation Units: Legal and Comparative Survey of Standards in the States of Minas Gerais, Rio de Janeiro and São Paulo. *Development and Environment (UFPR)*, v. 26, p. 57-70, 2013.

FORMAN, R.T.T. & GODRON, M. *Landscape ecology*. John Wiley & Sons, New York. 620 p. 1986,

Floriano, E.P. *Environmental planning*. Santa Rosa: ANORGS, 58p. 2004.

Fushita, A.T .; Araujo, R.T .; Pires, J.S.R .; Santos, J.E. Dynamics of natural vegetation and areas of permanent preservation in the city of Santa Cruz da Conceição (SP, Brazil). In: Santos, J.E .; Zanin, E.M .; Moschini, L.E. (Ed.) *Faces of landscape polysemy: ecology, planning and perception*. São Carlos: Rima, p.193-200. 2010.

Gherardi, D.F.M. *Metapopulation models*. *Megadiversity*, v.3, n. 1, p.56-63, 2007.

Guimaraes, J.C.C .; Machado, F.S.; Borges, L.A.C. ; Resende, J.L.P .; Soares, A.A.V. ; Santos, A.A. Legal aspects of the surroundings of the Brazilian conservation units: surrounding area and buffer zone in the face of Conama Resolution No. 428/2010. *Space and Geography (UnB)*, v. 15, p. 1-20, 2012.

Granziera, M.L.M. *Environmental Law*. 2. ed., Rev. and current. São Paulo: Atlas, 2011.

IBGE - Brazilian Institute of Geography and Statistics. *Municipal agricultural production: temporary and permanent crops*. Rio de Janeiro: IBGE, 570p. 2015.

IBGE - technical manual of land use. ministry of planning, budget and management, no. 7 - 2nd ed. rio de janeiro: ibge, 400p. 2013.

Junk, W.J. General aspects of floodplain ecology with special reference to amazonian floodplains. in: *the central amazon floodplain: ecology of a pulsing system*. junk, w.j. (ed.). springer-verlag. *ecological studies* 126: 3-20, 1989.

Lima, W. de P .; Ferraz, S.F. de B .; Ferraz, K.M.P.M. Biotic and abiotic interactions in the landscape: an eco-hydrological perspective. In: Calijuri, M. do C .; Cunha, D.G.F. (Ed.) *Engineering environmental concepts technology and management*. Rio de Janeiro: Elsevier, p.215-44. 2013.

Machado, P.A.L. Brazilian Environmental Law. 19. ed. São Paulo: Malheiros, 2011.

Machado, C.C.C. ; Gonçalves, C.U. ; Albuquerque, M.B. ; Pereira, E.C. Protected areas and their multiple territorialities - the social and environmental reflection on Catimbau National Park - Brazil. ENVIRONMENT AND SOCIETY (CAMPINAS), v. 20, p. 239-260, 2017.

Marques, A.L. ; Silva, J.B; Silva, D.G. Humid refuges of the semiarid: a study on the brejo of altitude and exposure of Areia-PB. Geotemas Journal. V.4, n.2. P.17-31, 2014.

Markham, B.L. & Barker, J.B. Thematic mapper band pass solar exoatmospherical irradiances. International Journal of Remote Sensing. v.8, no.3, p.517-523, 1987.

Mello, K. ; Petri, L. ; Cardoso-Leite, E.; Toppa, R.H. Environmental scenarios for the territorial planning of Permanent Preservation Areas in the municipality of Sorocaba, SP. Revista Árvore, v.38, n.2, p.309-317, 2014.

Metzger, J. P. Landscape structure and fragmentation: bibliographic analysis. Annals of the Brazilian Academy of Sciences, v.71, p.445-462, 1999.

Milaré, É. Environmental law: environmental management in focus. São Paulo: Editora Revista dos Tribunais. 921p. 2007.

Moraes, M.C.P. ; Mello, K. ; TOPPA, R. H. Analysis of the landscape of a buffer zone as a subsidy for the planning and management of conservation units. Tree Review (Printed), v. 39, p. 1-8, 2015.

Moraes, M.C.P. ; Mello, K. Integrated Management in Conservation Units: A case study of the Porto Ferreira State Park. Revista Brasileira de Ciências Ambientais (Online), v. 1, p. 45-59, 2014.

Naiman, R.J. ; Bilby, R.E. ; Bisson, P. A Riparian Ecology and Management in the Pacific Coastal Rain Forest. BioScience, v.50, n.11, p.996-1011, 2000.

Neri, U.D.B. ; Marques, A.L. ; Oliveira, J.D. ; Caluete, P.N.B. Simulation of buffer zone of Mata do Pau-Ferro State Park: Areia-PB. In: XVIII ENG, São Luís- MA. Nature / Environment. v. 1. p. 1-9. 2016.

Primack, R.B. & E. Rodrigues. Conservation Biology. Londrina. 328p. 2001.

Resolution n. 428, dated December 17, 2010. In the scope of environmental licensing, it provides for the authorization of the agency responsible for the administration of the Conservation Unit (UC),

which is dealt with in § 3 of article 36 of Law 9,985, dated July 2000, as well as on the science of the agency and responsible for the administration of the CU in the case of environmental licensing of projects not subject to EIA-RIMA and other measures. Available at: <www.mma.gov.br/port/conama/legiabre.cfm?Codlegi=641>. Accessed on: ten. 2018.

Rodrigues, E. Ecology of forest fragments along a gradient of urbanization in Londrina-PR. 1993. 110 f. Dissertation (Master in Ecology) -Universidade Federal de São Carlos, São Carlos, 1993.

Santos, R.F. Principles of environmental planning. Campinas, SP: Oficina de Textos, 247p. 2003.

Silva, M.C .; Queiroz, J.E.R.; Araujo, K.D .; Pazera Junior, E. Environmental conditions of the state ecological reserve of the forest of the wood stick, Areia-PB. Geography (Londrina), v. 15, p. 51-63, 2006.

Schowengerdt, R.A. Techniques for image processing and classification in remote sensing. London: Academic Press, 1980.

Vio, A.P.A. Damping zone and ecological corridors. In: BENJAMIN, A. H. Environmental law of protected areas - the legal regime of Conservation Units. Rio de Janeiro: University Forensics, p. 348-360. 2001.

Walter, M.T .; Walter, M.F .; Brooks, E.S .; Steenhuis, T.S .; Boll, J .; Weiler, K. Hydrologically sensitive areas: Variable source area hydrology implications for water quality risk assessment. Journal of Soil and Water Conservation, v.55, n.3, p.277-84, 2000.