Grassland Vegetation of Pitangui River Valley, Southern Brazil

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Abstract  A systematic floristic survey was carried out on native grasslands at Pitangui river valley areas, in the state of Paraná, Southern Brazil. Monthly samples collection covering an area of 9.4 ha over a two year period was conducted. A total of 51 angiosperm, one conifer and 4 fern families from four mesic steppic areas were identified. There were 196 genera and 420 species present in the area surveyed. The family Asteraceae contributed the highest species richness with a total of 119 species, 28% of the total. Herbs were found to dominate the area contributing almost 80% of all the plant forms. There were six non-native species, including African grasses and contaminating exotic pines observed and identified in the grassland area. Twelve native species, belonging to 11 families (contributing a total of 2.8% of all the flora identified) are listed as threatened. The high species richness and the considerably high number of threatened species in such a small area underlined the need for more conservation efforts in these grasslands. It is therefore recommended that additional zoning and better management effort be the primary concerns to conserve the area.

Keywords  Floristic, Grasslands, Riparian Area

1. Introduction

Native subtropical grasslands at South Brazil plateaus are located at high altitudes where low temperatures and high annual rainfall usually predominate. Riparian areas in Campos Gerais are combined by moderate to poorly drained soils, covered by hydrophilous steppes or by pioneering formations of fluvial influence, where Haplic Histosols, Melanic Gleysols, or Fluvic Leptosols can be encountered. In addition, hygrophilous to mesic steppes typically encompassing herbs and shrubs species, where Litholic Leptosols and Haplic Inceptisols are also available[1],[2].

The great ecological relevance of the Brazilian Atlantic Rainforest biome, which includes grasslands, has given this area the status as global biodiversity hotspots[3],[4]. The remaining grasslands in the state of Paraná have been suffering severe anthropogenic pressure, especially due to the expansion of agriculture and non-native forestry activities. However, despite the global importance of this grassland ecosystem, their floristic richness is hardly known. Therefore as one of the first steps of the Biodiversity of grassland-forest ecotones in South Brazil Project team was to provide a species checklist of Pitangui river valley native grasslands. Their adaptive lifeforms were previously discussed by Mioduski & Moro[5].

2. Methods

We carried out this floristic study in the dip slope of 1st cuesta of state of Paraná (Devonian Slope), inserted over Fumas sandstone, with medium altitude of 980 m a.s.l. The area is comprised of the region nationally known as Campos Gerais, specially where Pitangui river flows within a canyon in its medium curse crossing the Slope (J 594408 E 7232272), after Alagados dam, between Ponta Grossa and Carambeí municipalities, Paraná State (Figure 1). The climate is Cfb (altitudinal subtropical humid) according to Köppen’s classification, with mean annual temperature between 18 and 19°C, and an average rainfall of 1,600mm/yr[6].

Sample collection was carried out monthly over a two year period (August 2009/July 2011) in an 9.4 ha area inserted over Fumas sandstone formation on superficial soils of 1 meter or less. According to the Brazilian Soil classification system, the Abrigo Pitangui site (A) is an 2.1 ha concave slope with Haplic Cambissols, Litolic Neossols and Fluvic
Neossols in sequence. The Usina São Jorge site (B) is an 0.2 ha flat surface with Haplic Cambisols, The Fazenda Panorama site (C) is an 4.0 ha slightly convex slope with Haplic Cambisols, and the Mirante Pitangui site (D) is an 3.1 ha slightly convex slope with Lithic Neossols.

Botanical material was collected according to the wandering method described in Filgueiras et al.[7], that consists of listing the species presented in each delimited area as the investigator walks slowly on straight lines along it. Vouchers are deposited in the UEPG herbarium (HUPG), and research has been authorized by SISBIO 28694/1. For species’ taxonomic classification, Tryon and Tryon[8] and Smith et al.[9] for Ferns, and Angiosperm Phylogeny Group III[10] for Angiosperms were followed. The official plant names and their authors followed the electronic databases of Kew Gardens Plant List[11].

Evaluation and enumeration of the presence of extinction threatened species in the study area through comparison and review of Brazilian official threatened species lists [12],[13],[14] was also conducted. In addition, the presence of non-native plant (exotic) species was evaluated through revisions of the local governmental list [15] and Horus Institute[16].

3. Results and Discussion

Among the four areas, we recorded 421 taxa distributed in 51 Angiosperm families, one Conifer and 4 Ferns. There were present 420 species and 196 genera (Table 1). One Aristida taxon (Poaceae) was identified only at the generic level at this moment, needing further studies to settle it as a new species.

Table 1. Grassland plants present at Pitangui river valley, Southern Brazil. Habit: He – herbaceous; Sh – forbs; Tr- treelets; Li – prostrate herbs; He - Humic Cambisols; Ha - Haplic Cambisols; Ln - Lithic Neossols; Fc - Fluvic Cambisols

| Families/Species        | habit | threatened status | Predominant Soil type |
|-------------------------|-------|-------------------|-----------------------|
| **ACANTHACEAE**         |       |                   |                       |
| Dyschoriste hygrophiloides (Nees) Kuntze | He    | He, rare          | He, Ha, Ln             |
| Ruellia multiflora (Nees) Lindau | He    | He, rare          | He, Ha, Ln             |
| **AMARANTHACEAE**       |       |                   |                       |
| Alternanthera brasiliiana (L.) Kuntze | He    | He, Ha, Fc, Ln    | He, Ha, Fc             |
| Gomphrena macrocephala A. St.-Hil. | He    | rare              | He, Ha, Ln             |
| Pfaussia helichrysoide (Mart.) Kuntze | He    | He, Ha, Ln       | He, Ha, Ln             |
| Pfaussia jubata Mart. | He    | He, Ha, Ln       | He, Ha, Ln             |
| Pfaussia tuberosa (Spren g.) Hiden | He    | He, Ha, Ln       | He, Ha, Ln             |
| **AMARYLLIDACEAE**      |       |                   |                       |
| Nothoscordum gracile (Aiton) Stearn | He    | He, rare          | He,Ha, Ln, Fc          |
| Nothoscordum luteomajus Ravenna | He    | He, rare          | He, Ha, Ln             |
| **APIACEAE**            |       |                   |                       |
| Eryngium ebracteatum Lam. | He    | Ha, Fc            | Ha, Fc                 |
| Eryngium elegans Cham. & Schtdl. | He    | Ha                | Ha                     |
| Eryngium horridum Malme | He    | He, Ha            | He, Ha                 |
| Eryngium juncem Cham. & Schtdl. | He    | He, Ha, Ln       | He, Ha, Ln             |
| Eryngium sanguisohra Cham. & Schtdl. | He    | He, Ha, Ln       | He, Ha, Ln             |
| **APOCYNACEAE**         |       |                   |                       |
| Mandevilla atrivioidar (Stadelm.) Woodson | He    | He, Ha            | He, Ha                 |
| Mandevilla coccina (Hook. & Am.) Woodson | He    | rare              | Ha, Ha, Ln             |
| Mandevilla emarginata (Vell.) C.Ezcurra | He    | He, Ha            | He, Ha                 |
| Mandevilla pohliana (Stadelm.) A.H.Gentry | He    | He, Ha            | He, Ha                 |
| Oxypetalum subkinnatum Malme | He    | Li                | Li                     |
| Widgrenia corymbosa Malme | Li    | He, Ln            | Ha, Ln                 |
| **ARECACEAE**           |       |                   |                       |
| Allagopera campestris (Mart.) Kuntze | He    | He, Ha            | He, Ha, Ln             |
| Butia micropadix Burret | He    | rare              | He, Ha, Ln             |
| **ASTERACEAE**          |       |                   |                       |
| Acanthosperum australe (Loefl.) Kuntze | He    | Ha                | Ha                     |
| Achyrocline satiuroides (Lam.) DC. | He    | He, Ha            | He, Ha                 |
| Actinoseiris radiata (Vell.) Cabrera | He    | Fc                | Fc                     |
| Ageratum conyzoides (L.) L. | He    | He, Ha            | He, Ha, Ln             |
| Species                                                                 | Authority | Habitat |
|------------------------------------------------------------------------|-----------|---------|
| Angelphylum grisebachii (Baker) H.Rob.                                 | He        | Ha      |
| Aspilia montevidensis (Spreng.) Kunze                                   | He        | Ha,He,Ln|
| Aspilia reflexa (Sch.Bip. ex Baker) Baker                                | He        | Ha,Ln   |
| Austroeupatorium cf imilifiolum (Kunth) R.M.King & H.Rob.               | He        | He      |
| Austroeupatorium laetevirens Hook. & Am.                                | Sh        | Ha,He   |
| Baccharis articulata (Lam.) Pers.                                       | Sh        | Ha,Ln  |
| Baccharis axillaris DC.                                                 | Sh        | Ha,He,Fc|
| Baccharis brevifolia DC.                                                | Sh        | Ha      |
| Baccharis coridifolia DC.                                               | Sh        | Ha,Hc   |
| Baccharis draconemutilis DC.                                            | Sh        | Ha,Hc   |
| Baccharis semiserrata var. elaeagnoides (Stend.)                        | Sh        | Ha      |
| Baccharis ericiola DC.                                                  | Sh        | Ha      |
| Baccharis genistelloides (Lam.) Pers.                                   | Sh        | Ha      |
| Baccharis genistelloides subsp. crispa (Spreng.) Joch.Müll.             | Sh        | He,Fe,Ln|
| Baccharis glutinosa Pers                                                | Sh        | Ha      |
| Baccharis illinita                                                      | Sh        | Ln      |
| Baccharis linearifolia (Lam.) Pers. subsp linearifolia                  | Sh        | Ha,Ln   |
| Baccharis myricifolia DC.                                               | Sh        | Ha      |
| Baccharis pentodonta Maime                                              | Sh        | Ha      |
| Baccharis picata (Lam.) Baill.                                          | Sh        | Ln      |
| Baccharis uncinella DC.                                                 | Sh        | Ha      |
| Barnosoa bicornicifomis (DC.) R.M.King & H.Rob.                        | He        | Ha,Hc   |
| Bidens aida (L.) DC.                                                    | He        | He,Ln   |
| Calaeanefolia DC.                                                      | He        | Ha,Ln   |
| Calaea cymosa Less.                                                    | He        | Ha,Ln   |
| Calael parvifolia (DC.) Baker                                          | He        | Ha,Ln   |
| Calael triandra (Vell.) Pruski                                         | He        | Ha,Ln   |
| Campocelium macrocephalum (Less.) DC.                                   | He        | Ha      |
| Chaptalia graminifolia Cabr.                                            | He        | Ln      |
| Chaptalia integerrima (Vell.) Burkart                                   | He        | He,Fc,Ln|
| Chaptalia marinus (L.) Polik                                             | He        | He,Fc,Ln|
| Conysa bonariensis (L.) Cronquist                                     | He        | Ha      |
| Coreopsis lanceolata L.                                                | He        | Ha,He,Fc,Ln |
| Chromolaea ascendens (Sch.Bip. ex Baker) R.M.King & H.Rob.             | He        | He      |
| Chromolaea laevigata (Lam.) R.M.King & H.Rob.                          | He        | Ha,Ln   |
| Chromolaea stachyophylla (Spreng.) R.M.King & H.Rob.                   | He        | Ha      |
| Chrysolena flexuosa (Sims) H.Rob.                                      | He        | Ha      |
| Chrysolena nicolacki H.Rob.                                            | He        | endangered,Ln |
| Chrysolena oligophylla (Vell.) H.Rob.                                  | He        | Ha      |
| Chrysolena ptetensis (Spreng.) H.Rob.                                  | He        | Ha      |
| Chrysolena propinquia (Hemn.) H.Rob.                                   | He        | Ha,Ln   |
| Diacranthera crenata (Schdl. ex Matt.) R.M.King & H.Rob.               | He        | Ha      |
| Diasyphila filifolia (Hasl.) R.M.King & H.Rob.                         | He        | Ha      |
| Elephantopsmollis Kunth                                                 | He        | He,Fc,Ln|
| Emilia sonchifolia (L.) DC. ex DC.                                      | He        | Ha,He   |
| Erechites hieraciflous (L.) Raf. ex DC.                                 | He        | Ln      |
| Erechites valeriiflous (Link ex Spreng.) DC.                           | He        | Ha,Ln   |
| Eupatorium agrigandium Cabrera                                         | He        | Ha      |
| Eupatorium hirsutum Hook. & Am.                                         | He        | Ha      |
| Eupatorium multifidum DC.                                              | He        | Ln      |
| Eupatorium orbiculatum DC.                                             | He        | Ln      |
| Eupatorium palmare Sch.Bip. ex Baker                                   | He        | Ln      |
| Eupatorium serraatum Spreng.                                           | He        | Ha      |
| Eupatorium squarrosa Sch.Bip. ex Hook. & Am.                           | He        | Ha      |
| Eupatorium tanacetifolium Gillies ex Hook. & Am.                       | He        | Ln      |
| Gamochaeta purpurea (L.) Cabrera                                       | He        | Ln      |
| Grazielia multifida (DC.) R.M.King & H.Rob.                            | He        | Ln      |
| Heteroconylyx aequalis (Vell.) R.M.King & H.Rob.                       | He        | Ln      |
| Heterothalamus psediosides Less.                                       | He        | Ln      |
| Hieracium urvillei Sch.Bip.                                            | He        | He      |
| Hieracium ignatum R. Baker                                             | He        | Ln      |
| Hokochieus hieracoides (D.Don) Cabr.                                   | He        | He      |
| Hypochaeris glabra L.                                                  | He        | Ln      |
| Hypochaeris latea (Vell.) Britton.                                     | He        | He      |
| Hypochaeris radicata L.                                                | He        | He      |
| Inulopsis scaposa O.Hoffm.                                              | He        | Ha,He,Ln|
| Isostigma cridnifolium Less.                                           | He        | Ln      |
| Lepidaploa psilosomachya (DC.) H.Rob.                                  | He        | Ha,Ln   |
Lessingianthus arachnioides (Ekman ex Ekman & Dusén) H.Rob. He Ln
Lessingianthus asteriflorus (Mart. ex DC.) H.Rob. He Ha
Lessingianthus bardanoides (Less.) H.Rob. He Ha
Lessingianthus brevifolius (Less.) H.Rob. He Ha
Lessingianthus elegans (Gardn.) H.Rob. He Ha
Lessingianthus glabranus (Less.) H.Rob. He Ha, Ln
Lessingianthus grandiflorus (Less.) H.Rob. He Ha, Ln
Lessingianthus plantagineodes (Kuntze) H.Rob. He Ha
Lessingianthus polyphyllus (Sch.Bip. ex Baker) H.Rob. He Ha
Lessingianthus rubrcaulis (Bonpl.) H.Rob. He Ha
Lessingianthus simplex (Less.) H.Rob. He Ha, Ln
Lucilia acutifolia (Poir.) Cass. He Ha
Lucilia lycoptoides (Less.) S.E.Freire He Ha, He
Mikania micrantha Kunth Li Ln
Mikania oblongifolia DC. He He
Mikania sessilifolia DC. Li He
Noticastrum sericeum (Less.) Less. ex Phil. He Ha
Orthopappus angustifolius (Sw.) Gleason He Ha
Praxelis diffusa (Rich.) Pruski He Ha
Praxelis sanctopaulensis (B. L. Rob) R. M. King & H. Rob. He Ha, Ln
Pterocaikon akpectrooides (Lam.) DC. He Ha, Ln
Pterocaikon angustifolium DC. He Ha, Ln
Pterocaikon lunatum O. Kuntze He Ha
Senecio brasiliensis (Spreng.) Less. He Ha, He, Fe, Ln
Senecio conyzaefolius Bak. He He
Senecio oleosus Vell. He Ha, Ln
Solidago chilensis Meyen He Ha, Ln
Sonchus okraeaceus (L.) He He
Stenoccephalum megapotamicum (Spreng.) Sch.Bip. He He
Stevia cinerascens Sch.Bip. ex Baker He He
Stevia clausenii Sch.Bisch. ex Baker He He
Stevia linearifolia Walp. He Ln
Stevia undulata DC. He Ha, Ln
Stevia myriadenia Sch.Bip. ex Baker He Ha
Symphyotrichum squamatum (Spreng.) G.L.Nesom He Ha
Trichocline speciosa Less. He He
Verbesina sordescens DC. He Ha, Ln
Vernonanthura cuneifolia (Gardner) H.Rob. Sh Ha, Ln
Vernonanthura cussa (Vell.) H.Rob. Sh Ha, Ln
Vernonanthura nudiflora (Less.) H.Rob. Sh Ha
Vernonanthura westviania (Less.) H.Rob. Sh Ha
Vernonanthura riquihyli (Sch.Bip ex Kuntze) H.Rob. He Ln
Vernonia megapotamica Spreng. He He
Viguiera macrorhiza Baker He Ha, Ln
Viguiera panannensis (Malme) J.U. Santos He Ha, Ln
Viguiera trichophylla Dusén He Ha, Ln
Willoughbya officinalis (Mart.) Kuntze Li Ha

BIGNONIACEAE
Jacaranda caroba (Vell.) DC. Sh Ha

BORAGINACEAE
Moritzia dusenii I.M.Johnst. He Ha, Ln

BROMELIACEAE
Aechmea distichantha Lem. He Ln

CACTACEAE
Parodia otonis var. villa-velhensis (Brack. & Voll.) N.P.Taylor He Ln

CAMPANULACEAE

CARYOPHYLLACEAE
Cerastium dicrotrichum Fenzl ex Rehrb. He Ha, Ln
Silene gallica L. He Ha

CARYOCARACEAE
Caryocar brasiliense A.S.-Hil. Sh vulnerable Ha, Ln

CELASTRACEAE
Planchia populnea Reissek Tr Ha
Halimium brasiliense (Lam.) Grosser

Commelinaceae

Commelina villosa C.B.Clarke ex Chodat & Hassl.
Commelina virginica L.

Tradescantia cerinholoides Kunth

Convolvulaceae

Evokulus sericeus Sw.

Cucurbitaceae

Cayaponia espelina (Silva Manso) Cogn.

Cuscutaceae

Cuscuta racemosa Mart.

Cyperaceae

Bulbostylis capillaris (L.) Kunth ex C.B.Clarke
Bulbostylis scabra (J.Presl. & C.Presl.) C.B.Clarke
Bulbostylis vestita (Kunth) C.B.Clarke

Cyperus aggregatus (Wild.) Endl.
Cyperus hupan L.

Cyperus hystrix (Jacq.) H. St. 
Cyperus meyenianus Kunth

Cyperus rigens J.Presl. & C.Presl. subsp. rigens

Fimbristylis autumnalis (L.) R. Moore & Schult.
Fimbristylis dichotoma (L.) Vahli
Fimbristylis squarrosa Vahl

Kyllinga brevifolia Rottb.
Kyllinga odora Vahl. subsp. odora

Kyllinga pumila Michx.
Lagenocarpus rigidus (Kunth) Nees

Pycreus lanceolatus (Poir.) C.B.Clarke
Rhynchospora albaept Kunth
Rhynchospora conuariae (Kunth) Boeck
Rhynchospora corombosea (L.) Britton
Rhynchospora emaculata (Nees) Boeckeler
Rhynchospora glazioui Boeckeler

Rhynchospora globosa (Kunth) Roem. & Schult.
Rhynchospora hieronymi Boeckeler
Rhynchospora junceformis (Kunth) Boeckeler

Rhynchospora pallida M.A. Curtis

Rhynechospora rugosa (Vahl) Gale
Rhynchospora setigera (Kunth) Griseb.

Scleria hirtella Sw.

Dennstaedtiaceae

Pteridium arachnoideum (Kaulf.) Maxon

Droseraceae

Drosera brevifolia Pursh.
Drosera communis A.-St.Hil.

Drosera villosa A.-St.Hil.

Ericaceae

Agarista pulchella G.Don
Gaylussacia brasiliensis (Spreng.) Meisn.
Gaylussacia pseudogaultheria Cham. & Schltdl.

Eriocaulaceae

Actinocephalus polyanthus (Bong.) Sano
Eriocaulon ligulatum (Veill.) L.B.Sm.
Eriocaulon selvanianum Kunth
Leiohrix flavescens (Bong.) Ruhland

Paspalanthus abhavignatus Silveira
Paspalanthus planifolius (Bong) Korn.
Syngonanthus caulescens (Poir.) Ruhland

Erythroxylaceae

Erythroxylum microphyllum A.-St.-Hil.

Euphorbiaceae

Croton antisipholiticaus Matt.
Croton heterodoxus Baill.

Croton lancifolius (Didr.) Muell.Arg.
Croton myrianthus Muell.Arg.

Euphorbia hirsutifolia L.
| Species                                                                 | Distribution |
|------------------------------------------------------------------------|--------------|
| *Microstachys hispidula* (Mart.) Govaerts.                             | Sh           |
| **FABACEAE**                                                           |              |
| *Aeschynomene falcata* (Poir.) DC.                                     | He           |
| *Chamaecrista punctata* (Vogel) H.S.Irwin & Bameby                      | He, Ha, Ln   |
| *Chamaecrista devauxii* var. langsdorffii* (Vogel) H.S.Irwin & Bameby  | He, Ha, Ln   |
| *Clitoria densiflora* (Benth.) Benth.                                  | He           |
| *Cololacca speciosa* (Loisel.) DC.                                     | Sh           |
| *Crotalaria bakanae* Micheli                                            | He           |
| *Crotalaria hiliaria* Benth.                                            | Sh, Ha, Ln   |
| *Crotalaria micans* Link                                               | Lm           |
| *Crotalaria martiana* Benth.                                            | He           |
| *Desmodium adscendens* (Sw.) DC.                                       | He           |
| *Desmodium barbatum* (L.) Benth.                                       | He           |
| *Desmodium incanum* DC.                                                | He           |
| *Eriosema campestre* Benth.                                            | He, Ha, Ln   |
| *Eriosema crinitum* (Kunth) G.Don P.                                   | Li           |
| *Eriosema longifolium* Benth.                                          | He           |
| *Eriosema heterophyllum* Benth.                                         | He, Ha, Ln   |
| *Galactia benthamiana* Micheli                                         | He           |
| *Galactia boavistai* (Vell.) Burkart                                   | He, Lm       |
| *Galactia neesiis* DC.                                                 | He           |
| *Mimosa acerba* Benth.                                                 | Sh, Ha       |
| *Mimosa acerba* subsp. *acerba* var. *arrundes*                        | Sh, Ha, Ln   |
| *Mimosa acerba* subsp. *acerba* var. *foliolaria*                      | Sh, Ha, Ln   |
| *Mimosa brevipes* Benth.                                               | Sh           |
| *Mimosa dakoideis* Benth.                                              | Sh           |
| *Mimosa dokense* Vell.                                                 | Sh           |
| *Mimosa dokense* subsp. *acerba* (Benth.) Barneby                       | Sh, Ha, Ln   |
| *Mimosa dokense* var. *rigescens* (Benth.) Bameby                      | Sh           |
| *Mimosa debilo* Wild.                                                  | Sh           |
| *Mimosa micropteris* Benth.                                            | Sh           |
| *Mimosa orthacantha* Benth.                                            | Sh           |
| *Mimosa paranapiacabae* Bameby                                         | He           |
| *Mimosa ramosissima* Benth.                                            | Sh           |
| *Periandra mediterranea* (Vell.) Taub.                                 | Sh, Ha, Lm   |
| *Rhynchosis cosylifolia* Benth.                                         | Li           |
| *Stylosanthes guianensis* (Aubl.) Sw.                                  | He           |
| *Stylosanthes hippocampoides* Mohlenbr.                                | He           |
| *Vigna peduncularis* var. *peduncularis* (Kunth) Fawc. & Rendle       | Li           |
| *Zornia cryptantha* Arechav.                                           | Li, Ha, Lm   |
| *Zornia diphylia* (L.) Pers.                                           | Li           |
| *Zornia kafkalis* Sm.                                                  | Li           |
| **GESNERIAC EAE**                                                      |              |
| *Sinningia allagophylla* (Mart.) Wiehler                               | He           |
| **GLEICHENIAC EAE**                                                    |              |
| *Dicranopteris flexuosa* (Schrad.) Underw.                            | He           |
| *Gleichenella pectinata* (Willd.) Ching                                | He, Lm       |
| *Sticherus bifidas* (Willd.) Ching                                     | He           |
| **HYPERICACEAE**                                                       |              |
| *Hypericum cordatum* (Vell.) N.Robson                                 | He           |
| *Hypericum teretasculum* A.St.-Hil.                                   | He           |
| *Hypericum ternum* A.St.-Hil.                                          | He, Ha, Lm   |
| **HYPOXIDACEAE**                                                       |              |
| *Hypoxis decumbens* L.                                                | He, Ha, Fe, Lm |
| **IRIDACEAE**                                                          |              |
| *Sisyrinchium graminifolium* Lindl.                                    | He           |
| *Sisyrinchium laxum* Otto ex Sims                                      | He           |
| *Sisyrinchium micranthum* Cav.                                         | He           |
| *Sisyrinchium restiosidoides* Sprng.                                   | He           |
| *Sisyrinchium vaginatum* Sprng.                                        | Lm           |
| **LAMIAC EAE**                                                         |              |
| *Aegiphila paragueriensis* Briq.                                       | He           |
| *Hyptis pleuranoides* Benth.                                           | He, Ha, Lm   |
| Species                                      | Status | Location                |
|----------------------------------------------|--------|-------------------------|
| Hyptis turnata Pohl ex Benth.                |        |                         |
| Hyptis villosa Pohl ex Benth.                |        |                         |
| Peltodon longipes A.St.Hill ex Benth.        |        |                         |
| Peltodon rugosus Tolm.                      |        |                         |
| Rhabdochon gracile (Benth.) Epling           |        |                         |
| Sabia allicae E.P. Santos                    |        |                         |
| Sabia boyensis E.P.Santos                    |        |                         |
| Sabia lachnostachys Benth.                   |        |                         |
| Sabia nervosa Benth.                         |        |                         |
| Sabia rosmarinoidea A.-St.Hil.              |        |                         |
| **LYCOPODIACEAE**                            |        |                         |
| Lycopodium clavatum L.                      |        |                         |
| **LYTHRACEAE**                               |        |                         |
| Cuphea calophylla subsp mesostemon (Koehne)  |        |                         |
| Byrsonima brachybotrya Nied.                 |        |                         |
| Byrsonima guilliami ana A.Juss.              |        |                         |
| Byrsonima interna A.Juss.                    |        |                         |
| **MALVACEAE**                                |        |                         |
| Byttneria hatschbachii Cristóbal             |        |                         |
| Krapovikasia macdonald (DC.) Fryxell         |        |                         |
| Melochia lomentosa L.                        |        |                         |
| Peltorea speciosa (Kunth) Standl.            |        |                         |
| Pavonia schrankii Spreng.                    |        |                         |
| Pavonia sepium A.-St.-Hil.                   |        |                         |
| Sida vianum A.-St.-Hil.                      |        |                         |
| Waltheria indica L.                          |        |                         |
| **MELASTOMATACEAE**                          |        |                         |
| Acisanthera alsinaefolia (DC.) Triana         |        |                         |
| Acisanthera variabilis (DC.) Triana           |        |                         |
| Leandra australis (Cham.) Cogn.              |        |                         |
| Leandra enestriata (DC.) Cogn.               |        |                         |
| Leandra lucumosa Cogn.                       |        |                         |
| Leandra purpurascens (DC.) Cogn.             |        |                         |
| Leandra simplicicaulis Cogn.                 |        |                         |
| Miconia ligustroides (DC) Naudin             |        |                         |
| Miconia sellowiana Naudin                    |        |                         |
| Miconia theicans (Bonpl.) Cogn.              |        |                         |
| Rhynchancha brachyynchra Cham.               |        |                         |
| Tibouchina ceastifolia Cogn.                 |        |                         |
| Tibouchina debilis (Cham.) Cogn.             |        |                         |
| Tibouchina dubia Cogn.                       |        |                         |
| Tibouchina gracilis (Bonpl.) Cogn.           |        |                         |
| Tibouchina martialis (Cham.) Cogn.           |        |                         |
| **MORACEAE**                                 |        |                         |
| Dorstenia ozygiya Vell.                      |        |                         |
| **MYRTACEAE**                                |        |                         |
| Campomanesia adamantium (Cambess.) O.Berg    |        |                         |
| Campomanesia pubescens (Mart. ex DC) O.Berg  |        | rare                     |
| Campomanesia xanthocarpa (Mart.) O.Berg      |        |                         |
| Eugenia pittanga (O.Berg) Nied.              |        |                         |
| Eugenia panicifolia (Kunth) DC.              |        |                         |
| Myrcia multiflora (Lam.) DC.                 |        |                         |
| Myrcia pulchra (O.Berg) Kiaeck.              |        |                         |
| Myrciaria cuspitata O.Berg                   |        |                         |
| Myrciaria delicatula (DC.) O.Berg            |        |                         |
| Psidium guajavaeum Mart. ex DC               |        |                         |
| Family                        | Species                                                                 | Location |
|-------------------------------|--------------------------------------------------------------------------|----------|
| **ORCHIDACEAE**               | *Epidendrum secundum* Jacq.                                              | He       |
|                               | *Oncidium ponagrossense* Campacci                                        | He       |
|                               | *Saccola kancsoka* (Aubl.) Garay                                         | He       |
|                               | *Stenorrhynchus australis* Lindl.                                        | He       |
| **OROBANCHACEAE**             | *Buchnea kongfiaia* Kunth                                                | He       |
|                               | *Buchnea temfiaia* Kunth                                                | He       |
|                               | *Esterhazya splendida* J.C.Mikan                                        | Sh       |
| **OXALIDACEAE**               | *Oxalis napestris* A.S.-Hil.                                            | He, Ln   |
| **PASSIFLORACEAE**            | *Passiflora kelpota* Mast.                                              | Li       |
| **PINACEAE**                  | *Pinus elliottii* Engelm.                                                | Tr       |
|                               | *Pinus taeda* L.                                                         | Tr       |
| **PLANTAGINACEAE**            | *Angelonia integerrima* Spreng.                                          | He, L    |
|                               | *Plantago australis* Lam.                                                | He, L    |
|                               | *Plantago guilmemiana* Decne.                                            | He, L    |
|                               | *Plantago kancsoka* L.                                                   | He, L    |
|                               | *Plantago ximenosa* Lam.                                                | He, L    |
|                               | *Mecanoria procumbens* (Mill.) Small                                     | He       |
|                               | *Scoparia elliptica* Cham.                                               | He, L    |
| **POACEAE**                   | *Andropogon bicornis* L.                                                 | He, L    |
|                               | *Andropogon lecostachyus* Kunth                                          | He, L    |
|                               | *Andropogon microstachys* Desv.                                          | He, L    |
|                               | *Andropogon selkanus* (Hack.) Hack.                                      | He, L    |
|                               | *Andropogon tematus* (Spreng.) Nees.                                     | He, L    |
|                               | *Andropogon virgaicus* Desv.                                             | He, L    |
|                               | *Aristida sp*                                                            | He, L    |
|                               | *Aristida jebat* (Arechav.) Herter                                       | He, L    |
|                               | *Axonopus sicus* (Nees) Kuhnln.                                          | He, L    |
|                               | *Axonopus affinis* Chase                                                 | He, L    |
|                               | *Brachiaria decumbens* Stapf                                             | He, L    |
|                               | *Calamagrostis viridiflavaescens* (Poir.) Steud.                         | He, L    |
|                               | *Eleusine tristachya* (Lam.) Lam.                                        | He, L    |
|                               | *Elionurus muticus* (Spreng.) Kunzte                                     | He, L    |
|                               | *Eragrostis airodes* Nees                                                | He, L    |
|                               | *Eragrostis bahiensis* Roam. & Schult.                                   | He, L    |
|                               | *Eragrostis ciliaris* (L.) R.Br.                                         | He, L    |
|                               | *Eragrostis neesii* Trin.                                                | He, L    |
|                               | *Eragrostis pilosa* (L.) P. Beau.                                         | He, L    |
|                               | *Eragrostis polytricha* Nees                                             | He, L    |
|                               | *Eustachys distichophylka* (Lag.) Nees                                    | He, L    |
|                               | *Melinis minutiflora* P. Beau.                                           | He, L    |
|                               | *Melinis repens* (Wild.) Ziska                                            | He, L    |
|                               | *Panicum glabripes* Döll                                                  | He, L    |
|                               | *Panicum millegrena* Poir.                                               | He, L    |
|                               | *Panicum subulorum* Lam.                                                 | He, L    |
|                               | *Paspalum compressifolium* Swallen                                       | He, L    |
|                               | *Paspalum conjagaum* P.J.Bergius                                         | He, L    |
|                               | *Paspalum diktatum* Poir.                                                | He, L    |
|                               | *Paspalum distichum* L.                                                  | He, L    |
|                               | *Paspalum guanosum* Areachav.                                            | He, L    |
|                               | *Paspalum polyphyllum* Nees ex Trin.                                      | He, L    |
|                               | *Pennisetum purpureum* Schumach.                                         | He, L    |
|                               | *Schizachyrium condensatum* (Kunth) Nees                                  | He, L    |
|                               | *Schizachyrium spicatum* (Spreng.) Hetter                                 | He, L    |
|                               | *Sesaria parvilora* (Poir.) M.Kerguelen                                  | He, L    |
|                               | *Sorghastrum minarum* (Nees) Hitchc.                                     | He, L    |
|                               | *Spomobolus indicus* (L.) R. Br.                                         | He, L    |
| **POLYGALACEAE**              | *Momina cardocarpa* A.S.-Hil.                                            | He, L    |
|                               | *Polygala cyparissias* A.S.-Hil. & Moq.                                  | He, L    |
|                               | *Polygala kongicaulis* Kunth                                              | He, L    |
|                               | *Polygala mollugawfolia* A.S.-Hil.                                       | He, L    |
Families with the highest taxa number were Asteraceae (119) followed by Fabaceae (41), Poaceae (38) and Cyperaceae (28), summing up 54% of the total species richness, *i.e.*, the number of taxa in the area.

Previously, in Campos Gerais region, including both mesic and hygrophilous species, in the Vila Velha State Park grassland, Cervi *et al.*[17] have found around 47% of the species richness consisted of 182 taxa of the Asteraceae family, 130 Poaceae, 89 Fabaceae, and 47 Cyperaceae. In the same environment, in the Guaraté State Park, Carmo[18] has found 28% of the species richness composed of 79 Asteraceae, 42 Fabaceae, 35 Poaceae, and 22 Cyperaceae. Outside the conservation zone, those surveys restricted to hygrophilous species, in the Tibagi river valley, only 27 species from Asteraceae family were found, together with 24 species of Poaceae, and 18 Cyperaceae[19]. All these contributed 47% of the total species richness in the surveyed area. Kozer *et al.*[20], in the Iguazu river floodplain, have identified lesser, consisting of 15 species from Asteraceae family, 45 Poaceae 28, Cyperaceae and one Fabaceae, comprising 50% of the total species richness. The Asteraceae and Fabaceae species diversity increases the biological diversity due to the higher elevation of river banks, allowing the existence of non-hydmorphic soils.

Generally, the grassland of Paraguaçu river valley areas were dominated by herb species consisting of 79.8% of the total plant types. Shrubs which comprised the 15.4% consisted of the families, Asteraceae, Fabaceae, Malpighiaceae, Ericaceae, and Myrtaceae. In addition, treelets (1.0%) were observed consisted of the species Myrcia multiflora (Lam.) DC. and Plenckia populnea Reissek, both configuring rare plant forms in grasslands. The occurrence of these species is probably related to remnants of savannahs present in the vicinity of the study area. Prostrated herbs combine 3.8% of the phytocoenosis.

Twelve species are quoted on the list of threatened species of the state of Paraná[12] as rare: *Ruella multifolia* (Nees) Lindau (Acanthaceae), *Gomphrena macrocephala* A.St.-Hil. (Amaranthaceae), *Pfaffia jubata* Mart. (Amaranthaceae), *Mandevilla coccinea* (Hook. & Arn.) Woodson (Apocynaceae), *Butia microspadix* Burret (as *B. hatschbachii* Glasmann) (Areceaceae), *Halimum brasiliense* (Lam.) Gross. (Cistaceae), *Cayaponia espelina* Silva Manso (Amaranthaceae), and *Campomanesia pubescens* (Mart. ex DC.) O.Berg (Myrtaceae); as endangered: *Chrysolaena nicolackii* H.Rob. (Asteraceae), *Caphea hatschbachii* Lourteig (Lythraceae), and *Dorstenia cayapia* Vell. (Moraceae); as vulnerable: *Caryocar brasiliense* A.St.-Hil. (Caryocaraceae). In addition, there were six non-native grass species: *Brachiaria decumbens* Stapf,[15], *Melinis minutiflora* P.Beauv., *Melinis repens* (Wild.) Ziska, and *Pennisetum purpureum* Schumach.[16], all belonging to African genera of the Poaceae family. The high levels of biological contamination with the pines *Pinus taeda* L. and *Pinus elliottii* Engelm. (Pinaceae) and its implications for the Campos Gerais grassland Conservation have already been discussed by Ziller & Galvão[21]. They have found 76% of grassland with pine contamination and even point their
high potential for environmental degradation, public policies could not be effective yet for its control.

4. Conclusions

The species richness of Pitangui river valley grassland was higher (420 species on 8.3 ha) compared to available data from Campos Gerais region, as listed from the Vila Velha and Guartelá State Parks which were made upon larger protected areas. Asteraceae, Fabaceae, Poaceae, and Cyperaceae are the main families in this ecosystem. The presence of non-native species (4 species), and invasive Pinus species (2 species), and the increasing number of threatened species is alarming considering the location and the size of the area. Therefore, it is only high time to suggest that additional zoning and better management effort be the concern of the authorities to conserve the Campos Gerais National Park and its vicinities

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REFERENCES

[1] Marcia Freire Sá. Os solos dos Campos Gerais; In Mario S. Melo, Rosemeri S. Moro, Gilson B. Guimarães (Eds.), Patrimônio natural dos Campos Gerais do Paraná, Editora UEPG, Brazil, 2007. p.73-83. Online Available: http://ri.uepg.br:8080/riuepg//handle/123456789/445

[2] Rosemeri S. Moro “Vegetação em pedoambientes ripários dos Campos Gerais do Paraná: uma revisão bibliográfica”, UEPG, Terr@Plural, vol.4, no.2, pp.179-192, 2010. Online Available:http://www.revistas2.uepg.br/index.php/tp/article/view/1851

[3] MMA (Ministério do Meio Ambiente). Biodiversidade brasileira: avaliação e identificação de áreas e ações prioritárias para conservação, utilização sustentável e repartição dos benefícios da biodiversidade nos biomas brasileiros, MMA/SBF, Brazil, 2002.

[4] David N. Bilenca, Fernando Minaarro, Identificação de áreas valiosas de pastizal (AVPs) em las Pampas y campos de Argentina, Uruguay y sur de Brasil, FSVA, Argentina, 2004. Online Available:http://www.hcvnetwork.org/resources/folder.2006-09-29.6584228415/Libro-pastizal-0.pdf

[5] Janaine Mioduski, Rosemeri S. Moro, “Grupos funcionais da vegetação campestre de Alagados, Ponta Grossa, Paraná”, Fund. Zoobot. Rio Grande do Sul, Iheringia ser. Botanica, vol.66, no.2, pp.241-256, 2011. Online Available:

[6] Gilson F. Cruz. Alguns aspectos do clima dos Campos Gerais; In Mario S. Melo, Rosemeri S. Moro, Gilson B. Guimarães (Eds.), Patrimônio natural dos Campos Gerais do Paraná, Ed. UEPG, Brazil, 2007. p.59-72. Online Available: http://ri.uepg.br:8080/riuepg//handle/123456789/449

[7] Tarciso de Souza Filgueiras, Paulo E. Nogueira, Andrea L. Brochado, Gerald F. Guala II, “Caminhamento: um método expedito para levantamentos florísticos qualitativos”, IBGGE, Caderno de Geociências, vol.12, pp.39-43, 1994.

[8] Rolla M. Tryon Jr, Alice F. Tryon, Ferns and allied plants with special reference to Tropical America, Springer-Verlag, USA, 1982.

[9] Alan R. Smith, Kathleen M. Pryer, Eric Schuettpelz, Petra Korall, Harald Schneider, Paul G. Wolf, “A classification for extant ferns”, IAPT, Taxon, vol.55, no.3, pp.705-731, 2006.

[10] APG III. “An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III”, Botanical Journal of the Linnean Society, vol.161, no.2, pp.105-121, 2009.

[11] Online Available: http://www.thepiplantlist.org.

[12] Gerdt G. Hatschbach, Silvia R. Ziller, Lista vermelha de plantas ameaçadas de extinção no estado do Paraná, SEMA/GTZ, Brazil, 1995.

[13] Online Available: http://www.cetesb.sp.gov.br/licenciamento legislacao/federal/portarias/1992_Port_IBAMA_37.pdf.

[14] Online Available:http://portal.saude.gov.br/portal/arquivos/pdf/instrucao06.pdf

[15] Online Available :http://www.institutohorus.org.br/download/marcos_легис/Portaria_IAP_125_2009_Lista_Oficial.pdf.

[16] OnlineAvailable :http://www.institutohorus.org.br/inf_ficha_s.htm.

[17] Armando C. Cervi, Leonardo von Linsingen, Gerdt G. Hatschbach, Osmar S. Ribas, “A vegetação do Parque Estadual de Vila Velha, Municipio de Ponta Grossa, Paraná, Brasil”, MBM, Boletim do Museu Botânico Municipal, vol.69, pp.1-52, 2007.

[18] Maira R.B. do Carmo, “Caracterização fitofisionômica do Parque Estadual de Alagados, município de Tibagi, Estado do Paraná”, PhD thesis, Universidade Estadual Paulista, Brazil, 2006. Online Available :http://www.biblioteca.unesp.br/bibliotecadigital/document/?did=3763

[19] Bianca O. Andrade, Carina Kozera, Gustavo R. Curcio, Franklin Galvão, “Vascular grassland plants of Tibagi River Spring, Ponta Grossa, Brazil”, USP, Check List, vol.7, no.3, pp.257-262, 2011.

[20] Carina Kozera, Yoshiko Kuniyoshi, Franklin Galvão, Gustavo R. Curcio, “Composição florística de uma formação pioneira com Influência fluvial em Balsa Nova, PR, Brasil”, UFPR, Floresta, vol.39, no.2, pp.309-322, 2009.

[21] Silvia R. Ziller, Franklin Galvão, “O processo de degradação da Estepe Gramíneo-Lenhosa no Paraná por contaminação biológica de Pinus elliotti e P. taeda”, UFPR, Floresta, vol.32, no.1, pp.41-47, 2002.