Journal of Ecosystem Sciences and Eco-Governance (JESEG)
www.jeseg.carsu.edu.ph

Vol. 4, No. 2 | December 2022
PRINT ISSN 2704 4394 | ONLINE ISSN 2782 8522
DOI: https://doi.org/10.54610/jeseg/4.2.2022.004

SHORT COMMUNICATION

# Survey of Grasses (Poaceae and Cyperaceae) Within Caraga State University- Main Campus, Philippines

*Jelly R. Balicog, Gremarie D. Galdiano, Lynde P. Suganob, Romell A. Seronay, & Marlon V. Elvira**

Department of Environmental Science, College of Forestry and Environmental Science, Caraga State University, Ampayon Butuan City, Philippines

*Corresponding Author
*Email: mvelvira@carsu.edu.ph; marlonvelvira@gmail.com
Received: August 15, 2022
Revised: December 1, 2022
Accepted: December 26, 2022
Available Online: December 30, 2022



Cite this article: Balicog, J.R., Galdiano, G.D., Suganob, L.P., Seronay, R.A., & Elvira, M.V. (2022). Short Communication: Survey of Grasses (Poacea and Cyperaceae) Within Caraga State University- Main Campus, Philippines. *Journal of Ecosystem Science and Eco-Governance*, **4**(2):40-45.

ABSTRACT

Campus landscapes provide aesthetic appreciation and promote recreational activities, and ecological protection. Grasses are vital in providing major campus greenery, but their distribution, functional significance, and inventory are scarcely reported. This study focused on identifying grass species from the family Poaceae and Cyperaceae by determining their importance value, percentage cover, and economic uses within five sampling stations inside Caraga State University (CSU)-Main campus. Seventeen species of Poaceae and three species of Cyperaceae were documented inside the campus. Across the stations, Station 3 (Oval grounds) accounted for most of the grass species. The species belonging to the Family Poaceae have the highest percentage cover. The *Cyperus brevifolius* (Cyperaceae) showed a high relative frequency and importance value. However, this species is the most dominant across the sampling stations. The findings of this study are an excellent basis to assess further by looking at the various diversity indices to understand better ecological behavior and the importance of these species of grasses. The findings have implications for the ongoing infrastructure development of CSU by specializing in the design to expand landscapes, converting concrete areas into grass landscapes, and maintenance and conservation to allow various species to grow and establish.

Keywords: *Distribution, economic uses, importance value, Campus landscape*

Grasslands are one of the world's major ecosystems, covering almost one-third of the Earth's terrestrial surface (Lemaire et al. 2011). Grasses comprise a significant group in the flora biota of most campuses. Lawn planting appropriately supplemented with ornamental and non-grasses can provide aesthetic, recreational, and hygienic health benefits (Hrabe et al. 2003) apart from its functional ecological significance. Apart from the environmental relevance of grasses on the campuses, landscape aesthetics contribute to the cultural ecosystem services, which positively affect the recovery of attention, physiological stress, and emotional stress of humans (Kaplan and Kaplan 1989; Komossa et al. 2020). Nonetheless, invasive species of grasses are also common as these plants quickly adapt and, in the absence of their coevolved predators, explode in their new environments (Westbrook 1953; Mooney and Cleland 2001). Invasive plants, especially certain species of grasses are silent invaders that constantly encroach into parks, preserves, wildlife refuges, and urban spaces such as schools and campuses (Zedler and Kercher 2004). Clearing and other human activities encourage the establishment of invasive plants. On campuses, clearing land for buildings, farming and landscaping disturbs the original grass biota (Gelbard and Belnap 2003).

Taxonomically speaking, grass is any monocotyledonous plant species belonging to the big family (Gramineae or Poaceae) with narrow leaves, hollow stems, and clusters of tiny, mostly wind-pollinated flowers. The Cyperaceae, or sedge family, contains 104 genera and an estimated 5000 species, making it the third-largest monocot family in the world. They are prevalent all around the world, particularly in the tropics. While some of its constituents are dangerous agricultural weeds, others provide animal food and pharmaceuticals (David et al. 2021). The Poaceae family is one of the most well-known flowering plants, with over 600 genera and 10,000 species (Clayton et al. 1986). The primary food supply for humans worldwide is grasses of the Poaceae family. They also dominate ecologically, making up an estimated 40% of the Earth's land surface as grasslands or bamboo forests (Gibson 2008). This family of grass can adapt to a variety of habitats, including those in the arctic and at high elevations where flowering plants cannot thrive; ecological dominance in many ecosystems and high species richness are only a few of the characteristics that may contribute to its success (Linder et al. 2018). Inventory and diversity of species of grasses should be documented in the campus landscape. Nonetheless, the study would be helpful for campus conservation efforts to construct green infrastructure. The outcomes can also be a basis for future planning and conservation initiatives.

Five sampling stations were established within the campus for the grass assessment (Figure 1). Approximately 50 m was taken as an interval in each established station. In every station, five quadrats (1m x 1m dimension) with a grid in each were laid as a represented plot, respectively. In station 1 (oval grounds), only a few buildings have minimal vegetation cover. This minimal canopy cover allows the grasses to grow faster due to enough access to sunlight. Station 2 is situated in the New Science Building, where landscape and esthetic views are presently improved. The site is close to a route where people frequently pass. It has little sunlight

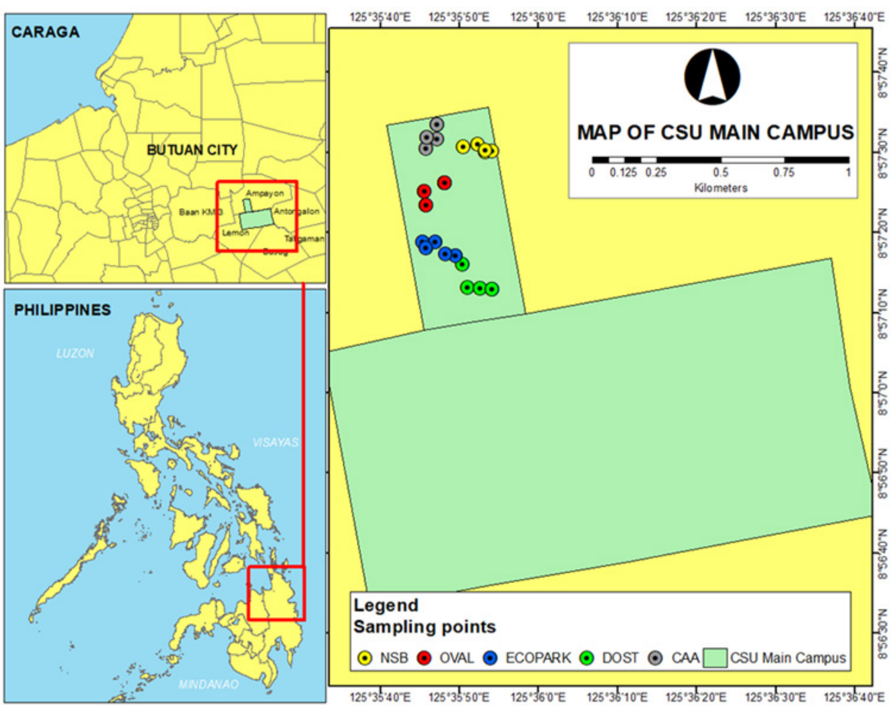


Figure 1. Sampling stations inside Caraga State University Main Campus. Station 1 is located at College of Agriculture and Agri industries, station 2 is located near New Science Building (NSB), Station 3 is at Oval, Station 4 is located at Eco- Park, and lastly, Station 5 is located near DOST building

due to the large trees surrounding the area. Station 3 is an open space with dominant shrub species and trees.

Furthermore, station 4 is located in the Eco-Park, where large trees with broad canopy are present. The grasses that thrive in this station have only limited access to sunlight. Station 5 is close to the DOST building, where a few large mango trees exist. On the site, certain portions of the property receive plenty of sunlight while others receive less. The analysis was carried out during the dry season when most plants were at the peak of their growth.

A GPS camera was used to locate the plots per area. After establishing the sampling areas, a 1m x 1m quadrant was utilized to survey the present species within the square. A representative sample of grass species was collected using scissors and placed in plastic zip locks, labeled, and documented. Photographs of the grass specimens were taken to aid the identification up to the species level.

The specimens were identified using various published articles on weed assessment (Carter 2005; Bryson and Carter 2010; Soreng et al. 2017; Larridon et al. 2021). Furthermore, various ecological parameters such as percentage cover, absolute frequency, relative frequency, density, relative density, and Species Importance value were calculated using Microsoft excel.

The survey documented 20 grass species belonging to Cyperaceae and Poaceae within the campus of CSU. The Cyperaceae family has three identified species, while the Poaceae family comprises 17 species (Table 1). Furthermore, station 3 had the most significant number of species compared to stations two and three (Table 2), probably due to the large open spaces in this area where there is sufficient light for photosynthesis. There are differences in the amount of light available beneath plant canopies, between gap and understory areas, and across plant species, as well as in their capacity to thrive in various strata of the vegetation canopy (Valladares et al. 2016). Shade tolerance is typically described as the species-specific minimal light requirement for survival. Station 5 (DOST) only has five identified species since the site is partially covered with tree canopies, resulting in insufficient sunlight

Table 1. Species Identification and Composition of Grasses across five sampling stations established within Caraga State University- Main Campus. Documented species from 1 to 3 belongs to Cyperaceae family, and species from 4-20 belongs to Poaceae family

| Species | Common Names | Family | Station | | | | | Distribution Status |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | |
| *Carex leptalea* Wahlenb. | Bristly-stalked sedge | Cyperaceae | | | / | | | Native |
| *Cyperus brevifolius* (Rottb.) Hassk. | Shortleaf Spikesedge | Cyperaceae | / | / | / | / | / | Native |
| *Fimbristylis miliacea* (L.) Vahl | Grasslike fimbry | Cyperaceae | | | / | | | Native |
| *Agrostis* sp. L. | Colonial bent | Poaceae | | | / | | | Native |
| *Axonopus fissifolius* (Raddi) Kuhlm. | Common carpet grass | Poaceae | / | | | | | Introduced |
| *Axonopus compressus* (Sw.) P.Beauv. | Broadleaf carpet grass | Poaceae | / | / | / | | | Introduced |
| *Arthraxon hispidus* (Thunb.) Makino | Small carpet grass | Poaceae | / | | | | | Native |
| *Cynodon dactylon* (L.) Pers. | Bermuda grass | Poaceae | / | | / | | | Native |
| *Digitaria* sp. Haller | Tropical-crab grass | Poaceae | | | / | | | Native |
| *Digitaria longiflora* (Retz.) Pers. | Lesser crabgrass | Poaceae | / | / | | | | Native |
| *Digitaria sanguinalis* (L.) Scop. | Hairy crab grass | Poaceae | | / | | / | / | Native |
| *Ehrharta stipoides* Labill. | Weeping grass | Poaceae | | | | | / | Native |
| *Eragrostis curvula* (Schrad.) Nees | Love grass | Poaceae | | | / | | | Introduced |
| *Microstegium vimineum* (Trin.) A.Camus | Japanese stilt grass | Poaceae | | | | / | | Native |
| *Muhlenbergia* sp1. Schreb. | Matted muhly | Poaceae | | | / | | | Native |
| *Muhlenbergia* sp2. Schreb. | Nimblewill- muhly | Poaceae | | | | | / | Native |
| *Oplismenus hirtellus* (L.) P. Beauv. | Basket grass | Poaceae | | / | | | | Native |
| *Panicum repens* L. | Creeping panic | Poaceae | | | / | | | Native |
| *Paspalum conjugatum* P.J. Bergius | Carabao grass | Poaceae | / | / | / | / | / | Introduced |
| *Rottboellia cochinchinensis* (Lour.) Clayton | Itch grass | Poaceae | | | / | | | Native |

penetration. Shade can decrease photosynthesis directly, but it can also indirectly affect the possibility of carbon acquisition through morphological and physiological acclimation responses (Niinemets and Valladares 2004; Niinemets 2007; Laanisto and Niinemets 2015). Lastly, station 4 (Eco-Park) had the least number of species identified because the area is almost covered with large trees where grasses hardly absorb sunlight. However, most grasses are rhizomatic, which means they can withstand stresses like fire, drought, and flooding. Even if a bare patch appears in the area, rhizomes can best fill those gaps (Chick 2021) naturally.

The analysis for specific ecological parameters showed that the family Poaceae has the highest percentage cover (85%) over the family Cyperaceae (15%), probably since Poaceae has a cylindrical and hollow stem, two glumes subtend its flowers. They contain nodes, which are considered essential spots on the plant where vital biological processes such as healing and structural support occur (Cope and Gray 2009; Clayton and Renvoise 1986). Unlike in Cyperaceae, these grasses are without nodes, and they flower by only one glume, which causes weak structural support. However, *Cyperus brevifolius* has the highest relative frequency (21.28%), highest relative density (16.4%), and highest importance value (37.72%) across all the stations (Figure 2).

Most of the grasses identified were economically important as feeds, forage for livestock, landscaping, soil binder, medicine, and some ornamental purposes. In addition, the accounted species found mostly appeared to be 80% native to the Philippines. Interestingly, areas in the university oval and Eco-Park have native species. With the advent of infrastructure development at Caraga State University, these areas should be managed and consider a balance on ecological integrity while pursuing the government's initiatives. However, specialized designs are necessary to expand landscapes, convert concrete areas into grass landscapes, and maintain and conserve to allow various species to move in and establish themselves. Documentation of other plant groups utilized for landscaping and other purposes is recommended

Table 2. Ecological parameters used to obtain Species Importance value and Percentage Cover across five sampling stations established within Caraga State University- Main Campus

| Species | % Cover | Absolute Frequency | Relative Frequency | Density | Relative density | Importance Value | Importance |
|---|---|---|---|---|---|---|---|
| *Carex leptalea* Wahlenb. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Cyperus brevifolius* (Rottb.) Hassk. | 10 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Fimbristylis miliacea* (L.) Vahl | 4 | 0.24 | 12.7 | 0.012 | 4.92 | 17.63 | 8.81 |
| *Agrostis* sp. L. | 4 | 0.08 | 4.26 | 0.008 | 3.28 | 7.54 | 3.77 |
| *Axonopus fissifolius* (Raddi) Kuhlm. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Axonopus compressus* (Sw.) P.Beauv. | 4 | 0.12 | 6.39 | 0.016 | 6.56 | 12.96 | 6.47 |
| *Arthraxon hispidus* (Thunb.) Makino | 6 | 0.4 | 21.28 | 0.04 | 16.4 | 37.72 | 18.85 |
| *Cynodon dactylon* (L.) Pers. | 8 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Digitaria* sp. Haller | 4 | 0.12 | 6.39 | 0.016 | 6.56 | 12.96 | 6.47 |
| *Digitaria longiflora* (Retz.) Pers. | 4 | 0.16 | 8.51 | 0.024 | 9.83 | 18.36 | 9.17 |
| *Digitaria sanguinalis* (L.) Scop. | 6 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Ehrharta stipoides* Labill. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Eragrostis curvula* (Schrad.) Nees | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Microstegium vimineum* (Trin.) A.Camus | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Muhlenbergia* sp1. Schreb. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Muhlenbergia* sp2. Schreb. | 4 | 0.16 | 8.51 | 0.008 | 3.28 | 11.79 | 5.89 |
| *Oplismenus hirtellus* (L.) P. Beauv. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Panicum repens* L. | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| *Paspalum conjugatum* P.J. Bergius | 10 | 0.12 | 6.39 | 0.024 | 9.83 | 16.24 | 8.11 |
| *Rottboellia cochinchinensis* (Lour.) Clayton | 4 | 0.04 | 2.13 | 0.008 | 3.28 | 5.41 | 2.7 |
| Total | 100 | 1.88 | 99.99 | 0.244 | 100 | 200.12 | 99.94 |

for future studies. It is always ideal to consider native grasses to be incorporated into the landscape, mainly if the goal is to restore the grass ecosystem. Native grass species have been used in the urban landscape as a water-conserving alternative to the traditional lawn (Knapp and Rice 2015).

**Acknowledgement**

The authors are grateful to the Center of Research and Environmental Management and Eco Governance (CRÈME) of Caraga State University for providing the opportunity to conduct this research. Special thanks to JC Jumawan for her substantial input to help improve this manuscript.

**Statement of Conflict of Interest**

All authors declare no conflict of interest.

**Literature Cited**

Bryson, C.T., & Carter, R. (2010). Spread, Growth Parameters, and Reproductive Potential for Brown Flatsedge (*Cyperus fucus*). *Invasive Plant Science and Management,* **3**, 240-245.

Carter, R. (2005). An introduction to the sedges of Georgia. Tipularia, 17-45.

Chick, S.T.L. (2021). All About Rhizome Grass (and why it's awesome). *Lawn Chick.* Retrieved May 26, 2022, from https://lawnchick.com/rhizome-grass/

Clayton, W.D. & Renvoise, S.A. (1986). Genera Graminum: Grasses of the world. London: *Royal Botanic Garden*, Kew. ISBN 9781900347754.

Clayton, W.D., & Renvoize, S.A. (1982). Flora of tropical East Africa, **3** [ed. by Polhill, R. M.]. Rotterdam, the Netherlands: *Balkema*, 560-561.

Cope, T., & Gray, A. (2009). Grasses of the British Isles. London, U.K.: *Botanical Society of Britain and Ireland.* ISBN 9780901158420.

David, C.Z., Hohmann, J., Vasas, A. (2021). Chemistry and Pharmacology of Cyperaceae Stilbenoids: A Review. *Molecules*, **26**(9), 2794. https://doi.org/10.3390/molecules26092794

Gelbard, J.L., & Belnap, J. (2003). Roads as conduits for exotic plant invasions in a semiarid landscape. *Conservation biology*, **17**(2), 420-432.

Gibson, D.J. (2008). Grasses and Grassland Ecology. *UK: Oxford University Press.*

Hrabe, F. et al. (2003). Grasses and lawns – what do you know about them. Olomouc, Vydavatelstvl lng. Petr Bastan – Hanacka recklami, 155.

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective.* Cambridge university press.

Knapp, E., & Rice, K. (2015). Starting from seed genetics issues in using native grass for restoration. Restoration and Management.

Komossa, F., Wartmann, F.M., Kienast, F., & Verburg, P.H. (2020). Comparing outdoor recreation preferences in peri-urban landscapes using different data gathering methods, *Landscape and Urban Planning*, **199**, https://doi.org/10.1016/j.landurbplan.2020.103796.

Laanisto, L., & Niinemets, Ü. (2015). Polytolerance to abiotic stresses: how universal is the shade–drought tolerance trade-off in woody species? *Global Ecology and Biogeography,* **24**, 571-580.

Larridon, I., Zuntini1, A.R., Léveillé-Bourret, E., Barrett, R.L., Starr, J.R., Muasya, A.M., Villaverde, T., Bauters, K., Brewer, G.E., Bruhl, J.J., Costa, S.M., Elliott, T.L., Epitawalage, N., Escudero, M., Fairlie, I., Goetghebeur, P., Hipp, A.L., Jiménez-Mejías, P., Izai, A.B., Kikuchi, S., Luceño, M., Márquez-Corro, J.I, Martín-Bravo, S., Maurin, O., Pokorny, L., Roalson, E.H., Semmouri, I., Simpson, D.A., Spalink, D., Thomas, W.W., Wilson, K.L., Xanthos, M., Forest, F., & Baker, W.J. (2021). A new classification of Cyperaceae (Poales) supportedby phylogenomic data. *Journal of Systematicsand Evolution,* **59** (4), 852-895.

Lemaire, G., Hodgson, J., & Chabbi, A. editors. (2011). Grassland productivity and ecosystem services. CABI, Wallingford, UK.

Linder, H.P., Lehmann, C.E.R., Archibald, S., Osborne, C.P., & Richardson, D.M. (2018). Global grass (Poaceae) success underpinned by traits facilitating colonization, persistence and habitat transformation. *Biological reviews of the Cambridge Philosophical Society*, **93**, 1125-1144.

Mooney, H.A., & Cleland, E.E. (2001). The Evolutionary Impact of Invasive Species. *Proceedings of the National Academy of Sciences of the United States of America*, **98**(10), 5446-5451.

Niinemets, U. (2007). Photosynthesis and resource distribution through plant canopies. *Plant, Cell & Environment,* **30**, 1052-1071.

Niinemets, U., & Valladares, F. (2004). Photosynthetic Acclimation to Simultaneous and Interacting Environmental Stresses Along Natural Light Gradients: Optimality and Constraints. *Plant biology* (Stuttgart, Germany). **6**, 254-68. 10.1055/s-2004-817881.

Soreng, R.J., Peterson, P.M., Romaschenko, K., Davidse, G., Teisher, J.K., Clark, L.G., Barbera, P., Gillespie, L.J., & Zuloaga, F.O. (2017). A worldwide phylogenetic classification of the Poaceae (Gramineae) II: An update and a comparison of two 2015 Classifications. *Journal of Systematics and Evolution,* **55**(4), 259-290.

Valladares, L.L., Ülo, N., & Miguel, A.Z. (2016). Shedding light on shade: ecological perspectives of understorey plant life. *Plant Ecology & Diversity,* **9**(3), 237-251, DOI: 10.1080/17550874.2016.1210262

Westbrooks, Randy, G. (1953). Invasive plants: changing the landscape of America: fact book! [senior author, Randy Westbrooks]. -- Washington, D.C.: *Federal Interagency Committee for the Management of Noxious and Exotic Weeds,* **1998**. [vi], 107 p.: col. Ill.; 28 cm.

Zedler, J. B., & Kercher, S. (2004). Causes and consequences of invasive plants in wetlands: opportunities, opportunists, and outcomes. critical *Reviews in Plant sciences,* **23**(5), 431-452.