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Biomass and environmental services of the *Pteridium aquilinum* (Lin.) Kuhn population, herbaceous formations located in the Wamba valley in the Democratic Republic of Congo

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KEYWORDS

Biomass
Carbon equivalent
Population
Pteridium aquilinum

DESCRIPTION

This study on the biomass and environmental services of *Pteridium aquilinum* populations in herbaceous formations located in the Wamba valley in the Democratic Republic of Congo is part of the development of local biological resources. *Pteridium aquilinum* is a perennial savannah grass that occupies an important place in the process of mitigation and adaptation to climate change, to the extent that individuals of this species form dense and homogeneous populations. These individuals are also capable of photosynthesis and sequestering atmospheric carbon. It is therefore important to be able to study the capacity of this perennial species to store a quantity of carbon.



OBJECTIVES

The objective is to evaluate the biomass, the carbon stock sequestered by the population of the species in order to understand its contribution to the fight against climate change. To achieve this general objective, we set ourselves the following specific objectives: identify the different populations of *Pteridium aquilinum* in the Wamba valley; define the sampling surface; harvest the aerial and underground vegetative parts; sort the different aerial vegetative parts; evaluate the biomass and carbon stock sequestered in plant tissues.

MATERIAL AND METHODS

The methodological approach boils down to inventories, collection and identification of botanical samples and measurement of biomass. The observations consisted of a field visit, prospecting the study site and carrying out the inventory. The laboratory work aimed at the scientific identification of the species of the population under study, and the steaming to extract the water and thus determine the water content contained in the organs of the plant studied. After locating the study area, it was a question of setting up the inventory system. The analyzes or studies of biomass of the *Pteridium aquilinum* species were carried out in an area of one hectare. This hectare constitutes the size of the device installed on the ground to study the population of the species. In the inventory system, botanical samples (leaves, rhizomes) were collected with the aim of facilitating their scientific identifications in the systemic, biodiversity, nature conservation and endogenous knowledge laboratory using key catalogs. identification and flora of Congo-Belgium and Rwanda-Urundi, at the INERA Herbarium of the University of Kinshasa. This identification was made according to the current revision of the classification according to APG III and IV. The identification stage is very important and required confirmation of observations made in the field by specialists. The collected material was also subject to other treatments such as drying and conservation in newspapers.

RESULTS

After processing and analysis of the data, the results show that the total biomass of all components (leaves and rhizomes) amounts to 6.07 t/ha; 2.75 t/ha of sequestered carbon and 22.27 t/ha of carbon equivalent. Individuals of the species contribute to the fight against climate change. These results demonstrate the importance of perennial grasses in solving climate problems. The information obtained in the study site shows the fresh weights of different organs or components (leaves and rhizomes) after weighing in the field in the plots. They are presented as follows: for the leaves a total of 9.8 kg and the fresh mass was recorded for the first plot; 8.6 kg for the second plot; 13.7 kg for the third plot and finally 16.3 kg for the fourth plot. For rhizomes: 3.6 kg for the first site; 3.3 kg for the second; 4.2 kg for the third and finally 4.8 kg for the fourth site. To complete the information on the mass of the mineral matter contained in the organs of this species, it was necessary to dry the samples in an oven to obtain the dry weight. Figure 2 shows the dry weights of different organs or components (leaves and rhizomes) after drying in the laboratory on the samples collected in the four different sites of the study area. They are presented as follows: for leaves 3.7 kg for the first site; 3.1 kg for the second plot (site); 4.9 kg for the third plot (site) and finally 6.2 kg for the fourth site. For rhizomes 1.2 kg for the first plot (site); 0.98 kg for the second site; 1.45 kg for the third site and finally 1.9 kg for the fourth site. Figure 2 illustrates the observations made on the dry weight of the organs of this species. The *Pteridium aquilinum* population also plays an important role in reducing carbon dioxide from the atmosphere and thus contributes to climate change mitigation measures. Individuals in the population carry out photosynthesis and store carbon in their tissues. This research reveals a value of 2.75 t/ha of carbon sequestered by individuals of the species under study. The young shoots of individuals of the aforementioned species are consumed as vegetables by the communities bordering this valley and can even supply a small business at the local level and even in urban centers like Kenge and Kinshasa. This same



species also constitutes a host plant for caterpillars which consume the leaves and for which several species of butterflies can lay their eggs. It is a multi-use plant although it grows in herbaceous formations. During the rainy season and even during the dry season, individuals of the species under study always keep their green leaves. In other words, these individuals carry out photosynthesis throughout the year unlike several other forest species which lose their leaves during the dry season. These arguments once again affirm the considerations on the contribution of populations of this species in the fight against global warming, a major environmental problem which currently affects all of humanity.

In the Wamba valley in Kwango as well as in Kwilu in the Democratic Republic of Congo, we can easily observe vast expanses of plant formations dominated by individuals of *Pteridium aquilinum* which form much more compact and homogeneous populations. It is therefore important to specify that in this type of vegetation, there are scattered some species of herbaceous formation which accompanies the population of this species. This is particularly the case for the following species: *Hymenocardia acida*, *Hymenocardia ulmoides*, *Digitaria polybotria* etc. this vegetation evolves more in the slope areas and is more subject to bush fire fueled by humans.

CONCLUSION

The results of this research constitute a contribution to the knowledge of biomass and environmental services: carbon sequestration, regulation of the water cycle, soil protection, that is to say the ecological functions which relate to the life cycle of the species *Pteridium aquilinum*. It is interested in the production of perennial grass and focuses on the valorization, use and conservation of the resource. The approach used brings innovation because it addresses a systemic or holistic approach in the study of the population of the species and demonstrates the existing relationships between the life cycle of the species, its services for the environment and the mechanisms that must be put in place to rationally manage the resource also based on the endogenous knowledge of local communities. The study on the biomass and environmental services of *Pteridium aquilinum* populations is part of the protection of the environment and natural biological resources. It showed the contribution of populations of this fern species to measures to combat global warming. The study area is part of the Guinean-Congolese-Zambézian regional transition zone, more precisely in the herbaceous formations located along the Wamba River valley in the DRC (Democratic Republic of Congo). To achieve this, observations and floristic inventories supported by a direct method which consists of clearing or extirpating individuals of the species, constitute the methodological approach used for the study of the total biomass of the species concerned. After processing and analysis of the data collected in the field, the main results retained are as follows: 6.07 t/ha of biomass; 2.75 t/ha of sequestered carbon and ultimately 22.27 t/ha of carbon equivalent. The inventory revealed 11 species divided into 8 families and 11 genera of which the species *Pteridium aquilinum* is the most dominant because it has several individuals in our study environment. The results obtained prove that savannahs constitute important carbon stock sinks. The *Pteridium aquilinum* population contributes to the process of reducing atmospheric carbon dioxide and this can serve as a basis for the conservation of the vast areas colonized by individuals of this perennial species which, very often, are victims of bush fires.