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SEED BANK INVESTIGATIONS OF AN ABANDONED FARMLAND IN NNAMDI AZIKIWE UNIVERSITY, AWKA. ANAMBRA- STATE. NIGERIA.

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Abstract

The effects of Abandonment on a former farmland seed bank was studied to determine the differences between the above ground vegetation and seed bank vegetation. Similarities was measured using Soresen index and the above ground vegetation was determined through transects and Auuger (7.5cm) sampling of different horizons of the soil.
Keyword: ***Seed Bank, Farmland and Vegetation***

INTRODUCTION

A Seed bank is defined as a population of viable and non viable seeds buried in the soil at a given time which is used to determine the above ground vegetation succession origins in natural ecosystems and agricultural systems.

Studies by Christoffoleti and Caetano, (1998) emphasized that seed bank studies in both natural vegetation and agricultural systems are not homogenously and normally distributed. This factor is caused by the inherent heterogeneity of seeds in the soil. Although seeds are shed naturally close to their parent plants, there is a strong departure in the randomness of their distribution in the soil as most abundant species have a normal distribution while the less abundant species have a Poisson or aggregated distribution. This confirms an earlier observation by Benoit et al., (1989) which emphasized that seed bank populations in agricultural and natural vegetations are frequently and erroneously assumed to be heterogeneous and normally distributed while the less abundant species have a Poisson or aggregated distribution..

However, Seed bank according to Kellerman and Van Rooyen (2007) represents a pool of vegetative potential and a source of genetic inheritance which plays a vital role in vegetation establishment after a disturbance. The absence of a soil seed bank has important consequences for the dynamics of a specie or vegetation type because in such cases, the vegetation cannot regenerate from the soil stored seed bank after disturbances occurs. Therefore, a soil seed bank therefore is not static entity and the seed density and species composition of the seed bank flora constantly varies in time and space.. Dainou et al. in (2011) defined Soil Seed bank as the store of viable seeds buried in the soil at a given time, which represents a record of recent vegetation of that area. Although weeds have always been a problem in cropping systems, high weed densities reduces crop yield and quality, leading to different proposals for an alternative means of weed management techniques. In the older times, weed control was traditionally accompanied by mechanical means (hoeing, plowing, ploughing, hand weeding use of herbicides.

LITERATUREREVIEW

Seed bank studies of abandoned farmland

Falinska (1999), investigated seed bank dynamics in abandoned meadows after 20-years in Bialowieza National park where it was discovered that seed densities in the soil fluctuated as succession proceeded and that the floristic richness of the seed bank decreased during succession with the number of species falling from 38 to 25 although the diversity of life forms increased in later years with tall herbs, shrubs and trees appearing after 10-years.However, it was concluded by Falinska (1999), who stated that seed bank floristic composition is apparently both a product of species composition of current vegetation and a record of long term substitution of species which may be influenced by certain factors such as structure of vegetation which indirectly influences accumulation of seeds in the soil and such fluctuations increases with succession. Toledo and Martinez-Ramos (2011), assessed the availability of both pioneer and non-native species in the soil seed bank of old-growth forest and recently abandoned pasture, to evaluate whether the soil seed bank in these pastures represents a source of regeneration of species from adjacent old-growth forest or of invasion by non-native species. Soil samples were randomly collected from six sites in old-growth forest, and six sites in abandoned pastures. Seedlings from soil samples were identified and classified into pioneer, non-native (weeds/ graminoids), and other forest species. Pioneer species seeds were virtually absent in pastures, but represented 30% of seeds in the forest. Non-native species comprised 99% of the soil seed bank in pastures. In the forest, soil seed bank density of weeds and graminoids decreased with increasing distance (up to 4 km) from agricultural fields, and comprised up to 25% of the seed bank. Their results showed a near total elimination of pioneer species from the soil seed bank in pastures, and considerable invasion of the borders of the Montes Azules reserve by seeds of non-native species. Thus, the soil seed bank in abandoned pastures represents a source of invasion by non-native species into old-growth forest rather than a potential source of forest regenerationof using herbicides for weed control produced a number of herbicide resistant species which was 183 for both monocots and dicots.(Heap, 2007).

Factors affecting soil seed bank dynamics.

There are a lot of environmental factors that can affect soil seed bank such as the following:

Different Weed Management practices in agricultural systems: Weed management practices such as herbicide treatment, hand weeding treatment, hoe weeding treatment, and so many others affects the soil seed bank. Takim *et al*. (2013) investigated the different relationships between previously cultivated land and continuously cultivated land and natural fallow fields. The result showed that land use significantly influenced both weed seed bank and floristic composition of the area under study. However, they reported that a linear relationship exists between the seed number and seedling emergence which differed across the cropping systems, weed control and land use intensities. Also, it was established that previously natural fallow fields had a relatively narrow range of emergence (15.8- 33.6%) while other land use intensities had a much more average range of emergence (21-39%) and 23- 37% for continuously cultivated cowpea fields.

Impact of fire: Fire as an ecological phenomenon can affect the soil seed bank dynamics either positively or negatively. Tasfaye *et al.* (2004) in their studies at Harenna forest discovered that after a major fire outbreak in 2000, 140 seeds germinated from unburnt soil samples while 15 seeds germinated from burnt soil sample. Also, many researchers have successively eliminated French broom (*Genista monspessulana*) an invasive species, through prescribed burning and restored the native plant communities in coastal California grassland. This implies that fire could destroy most species in the forest and exhaust the soil seed bank. However, the regeneration of the site with pioneer species was quicker than in the unburnt site. Recent studies have revealed that majority of species with soil- stored seed banks have dormancy and germination cues due to passage of fire. For example, physically dormant seeds have hard impenetrable seed coat which is rendered permeable through heat shock from fire without little response to smoke (Ooi, 2012).

Soil Characteristics: Clement *et al*. (1996) highlighted how soil characteristics influence weed seed distribution. He emphasized that understanding the impact of management practices on the vertical distribution of seeds can assist in predicting weed emergence patterns. In soils with small weed seeds less than half germinated at very shallow depths while more seeds reserved at deeper depths germinated later. Studies by Gallagher and Cardina (1998) showed that in no tillage systems, seed bank densities are higher in tilled systems with the seeds concentrated near to the soil surface of about 15 cm depth. This was confirmed by Takim et al., (2013). Moreover, Menalled (2001) showed that weed seeds disperse both horizontally and vertically in the soil profile. It was confirmed that horizontal distribution of weeds in the seed bank follows direction of crop rows while type of tillage determines the vertical distribution of seeds. In plowed fields, majority of weed seeds are buried 4-6cm below the surface. Also, under reduced tillage systems using chisel plowing, 80-90 % of the weed seeds are distributed in the top soil i.e. 1-4cm of the soil profile while in no tillage fields, majority of weed seeds remain near the soil surface.

Soil sampling method: Researches in soil seed bank have reported that the use of soil sampling is not only labour and time intensive but also cumbersome hence no universal standard soil sampling unit has been used. In most seed bank studies, the sampling cost, avai lable resources (time, space and labour) and the sampling tool have dictated an arbitrarily chosen sample size (Benoit *et al.*, 1989). Meanwhile, the optimal sample size (Total number of sampling units) required in any seed bank studies has been investigated and a general agreement is that a large number of small sampling units is more appropriate than a smaller number of large sampling units. However, the above opinion was based on studies with benthic invertebrates

Dormancy and seed germination

Several internal and external factors prevent seed germination. The internal factors are the presence of a seed coat, which is a barrier to the penetration of water and oxygen; presence of a biochemical inhibitor in the seed; and immature embryo. Among the external factors, the most common are soil water content and temperature (Fernández-Quintanilla *et al.*, 1991).

Seed dormancy is another characteristic that affects the seed bank reservoir. The seed populations of several vegetable species behave in different ways with respect to germination; the weeds produce polymorphic seeds, with a certain proportion that is dormant and others which was not dormant (Freitas, 1990).

Carmona (1992) used the term innate dormancy (primary) and induced dormancy (secondary) to characterize the development of the dormancy in the mother plant and after the dissemination in space, respectively. The term enforced dormancy has been used for the inability of the seeds to germinate due to an environmental restriction, like water deficit, low temperature and poor aeration. However, some seed physiologists do not consider the induced dormancy as an actual dormancy since the seed does not germinate because of the absence of environmental conditions and characteristics of the seed, since the seed does not need to break dormancy but responds only to favourable conditions for germination. This situation is more conveniently referred to as a case of quiescent seeds.

Dormancy represents a main mechanism of species preservation in the seed bank, distributing the germination through the year. It can guarantee the species survival in the form of seeds, under adverse conditions, even when the population of plants is completely eliminated.

Since seed germination involves all the processes that begins with the uptake of water by a quiescent dry seed and terminates with the elongation of embryonic axis. According to Salazar, (2010) most seeds requires water, oxygen and suitable temperature for germination. Therefore, a dormant seed is referred to as a seed that cannot germinate in a specified time under favorable conditions of temperature, moisture and light whereas a non dormant seed will germinate under the same conditions mentioned above. Baskin and Baskin (2005) explained further that five (5) types of dormancy which exists among seeds namely; physiological, morphological, morphophysiological, physical and physical-physiological. In a simplest form of explanations; Seeds with physiological dormancy cannot germinate because of a physiological problem with the embryo for example low growth potential. Morphological dormancy is caused by the presence of small or underdeveloped embryo which must grow to a species- specific critical length before radicle emergence. Also, seeds with morpho-physiological dormancy have underdeveloped embryo coupled with physiological dormancy, thus germination cannot occur until physiological dormancy is broken.

Physical dormancy is caused by one or more water impermeable seed coats or fruit coats and breaking of such dormancy requires disruption of a specialized area of the seed (E.g. lens in Fabaceae) or fruit coat thereby creating opening for water entry. Seeds with physical- physiological dormancy have impermeable seed coats or fruit coats and physiologically dormant embryos. However, exposure of seeds to the above ground can stimulate germination thereby affecting the Red: Far red ratio of phytochrome of the seed (Baskin and Baskin, 2004)

Fatal germination of seeds: This factor affects the seed bank as confirmed by Davis and Renner (2007) which was traced to depth of radicle emergence. Fatal germination increased with soil depth and also soil pathogens which cause fatal germination.

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Fatal germination of seeds: This factor affects the seed bank as confirmed by Davis and Renner (2007) which was traced to depth of radicle emergence. Fatal germination increased with soil depth and also soil pathogens which cause fatal germination. Seed bank assessment strategies. Two standard approaches are used to estimate seed bank composition and density. First is separation of seeds from a soil sample and counts of emerged seedlings from soil samples (Luschei, 2003). While seed separation is time consuming and expensive in terms of labour, counts of emerged seedlings do not give a full picture of the seed bank since dormant and dead seeds as well as seeds that need special vernalization are not always reflected. There are many ways of separating seeds from soil samples. In the modified floatation method (Buhler and Maxwell, 1993), seeds are separated from soil using a solution of K_2CO_3 and centrifugation. This method allows recovery of several seeds of several species but affects their germination negatively. However, Gross and Renner (1989) used a modified elutriator to remove seeds from soil samples. Although this method gave good recovery rates for the three species tested and had no effect on the seed viability, it was rather time consuming. Gross (1990) compared germination efficacy with a cold treatment versus germination without cold treatment and elutriation. She discovered that germination with cold treatment is the most complete estimation of the composition of the seed bank. Separation of seeds by elutriation gives a higher estimate of the density of seeds because of the inclusion of non-viable seeds in the samples.

MATERIALS AND METHODS.

Description of the study area.

The abandoned farmland is located in opposite Cisco Engineering department, Unizik, Awka. Awka and was abandoned for three years (from 2012 to 2015). sites are within the capital territory Awka, Anambra state (Latitudes $6^{o}12^{1}25^{1}$ $N7^{o}04^{1}04^{1}$ E / 7.06778^{o} E coordinates (https://eh.m.wikipedia.org> wiki Awka retrieved 16/08/2018). Richard (2005) mentioned that Awka lies between latitudes 7^{0} 00^{1}N and 7^{0} 10^{I} N, and 6.2220^{o} N, 7.0821^{o} E (https//www.google.com retrieved 18/02/2019). Also, Awka lies on latitude 6.2127 and longitude 7.0720((https://eh.m.wikipedia.org>wiki. Awka retrieved 18/02/2019). Awka is sited on a tropical valley but most of the original rainforest has been lost due to clearing for farming and human settlement.

SAMPLING TECHNIQUES

A GPS map of each study location was taken before the vegetative data collection began which was used in producing the map of the study area. Method of Sampling**:** Determination of above ground vegetation:

Sampling Procedure.

By means of simple random sampling, four belt transects were chosen in a sampled area of 10 x10 meters which was marked out using a measuring tape, giving a sampling area of 100 m^2. Also, using a baseline of 10 meters, ten belt transects of 1 m by 10 m were created and by simple random sampling, four out of the ten belt transects was selected for quadrat sampling i.e (transects 2,5,6,8). A 1m x1m quadrat was used to sample each belt transect ten times which equals to 40% sampling intensity. All plant species found inside the quadrat were counted as species present

Soil sampling method

The experimental plot was sampled using a soil Auger of 7.s5 cm diameter. The different horizons of the soil, 0-5cm, 5-10cm and 10-15cm of the quarter of each of the plots were collected at four points and then mixed together for each site. Soil seed bank density, diversity and composition of the plant species were assessed for this study. The collection of the soil samples from 3 separate layers of 5cm thick (0-5cm, 5-10cm, 10-15cm) deep conforms to the methods of Degafi and Berhanu (2013).

The litter layer was included with the soil samples as 4th layer because of its potential to contain high number of seeds (Esmailzadeh *et al*., 2011). The samples were taken from similar layers of these four points within a plot was mixed to form a soil composite in order to reduce variability within the plots for each study site. Then, persistent and transient seedlings were counted as in Tesfaye *et al*., (2004).

The composite sample for each soil layer was again divided into three equal parts among which one third (1/3) was randomly selected for further soil analysis while the remaining two third (2/3) was used for the seedling emergence experiment.Soil sample collection was completed within two weeks to avoid differences between habitats, and thus any temporal bias in seed availability and composition (Toledo and Martinez- Ramos, 2011)

Air drying of Soil samples.

Soil samples were collected and spread out on brown sheets of paper at room temperature for four weeks. Plant debris were removed with hand and one third of the soil was sieved with 2mm sieve and used for soil physiochemical analysis.

3.6.2 Seedling Emergence Test.

Soil samples collected from each study site were spread into round plastic trays of 29cm x 20cmx 6cm, which were used as germination trays. Each plastic tray was perforated at the base at 1cm and the perforation was covered with cotton wool to avoid leakage of soil samples and to facilitate drainage of excess water in the samples. The soil samples (15 of them) were kept in a screen house near the Botany laboratory, Department of Botany of Nnamdi Azikiwe University, Awka. Anambra State. The screen house was roofed with plastic roofing sheets to allow light penetration. The plastic trays were placed on a wooden basement of about 40cm from the floor. The experiment commenced on 20/9/2016 and ended on 31/3/2017. The soils were watered daily to field capacity (about 100cm of tap water) for about six months and the soils were stirred every two weeks for light effects on germination. Also, the soils were stirred continuously to identify germinated seedlings. Emerged seedlings were counted and recorded at 3weeks, when germination commenced and then every week. At 12weeks then most of the germinated seedlings finished their life cycles and for the remaining 3 months, only dormant seedlings emerged at sporadic intervals.

COMPUTATION OF DATA

After sampling, in order to quantify specie density and specie abundance the following statistical analysis was computed as follows:

$$\textbf{Density} = \frac{\text{No of each species}}{\text{Total area sampled.}}$$

$$\textbf{Relative density} = \frac{\text{Density of each species}}{\text{Total density of all species}} \times \frac{100}{1}$$

$$\textbf{Frequency} = \frac{\text{No of times a species occurred}}{\text{Total no of times searched for}} \times \frac{100}{1}$$

$$\textbf{Relative freq.} = \frac{\text{Frequency of each species}}{\text{Total frequency of all species}} \times \frac{100}{1}$$

Important value Index = Relative density + Relative frequency.

COMPUTATION OF SPECIES DIVERSITY

Shannon – Wiener index of diversity was used to determine the species diversity of the sampled plots using the formulae:

$H^{I} = \text{Ln} \sum (\text{pi X In Pi})$ **H^{I} = ShannonWieners index.**

$H^{I}\ \text{max} = \text{Ln s}$ **H^{I} max = Maximum equitability**

$$E = \text{Equitability} = \frac{H^{I}}{H\ \text{max.}}$$

Pi = Proportion of i species in the community.

Ln = natural log.

S = total no. of species.

RESULTS

4.3 ABOVE GROUND SPECIES ABUNDANCE OF ABANDONED FARMLAND, AROUND UNIZIK.

The summary of the abundance status of sampled transects can be seen in table 2. In transect 2, the unknown species A (Asteraceae) was most abundant species.This was followed by *Desmodium scropurius* and *Chromolaena odorata*. In transect 5, Unknown species Asteraceae family was most abundant, followed by *Chromolaena odorata* and *Desmodium scropurius*. In transect 6, *Desmodium scropurius* was most abundant, followed by *Chromolaena odorata* and *Manihot esculentus*. Also, in transect 8 *Chlomoleaena odorata* was most abundant, followed by *Imperata cylindrica* and *Manihot esculentus*.

Table 1: Above ground species composition for Abandoned Farmland plot, unizik.

Plant species	*Family*	*Transects*			
		2	**5**	**6**	**8**
Acanthus montanus	Acanthaceae		X	X	x
Aceroceros spp	Poaceae	X	X		
Artemesia vulgaris	Asteraceae	X	X		X
Aspilia africana	Asteraceae	X	X	X	X
Axonopus compressus	Poaceae	X	X	X	X
Bracharia spp	Poaceae		X		
Calapagonium mucunoides	Fabaceae	X	X	X	X
Celosia leptostachyma	Amaranthaceae		X	X	
Chromolaena odorata	Asteraceae	X	X	X	X
Citrullusvulgaris	Curcubitaceae	X			X
Cnestis ferruginea	Connaraceae	X	X	X	X
Combretum hispidum	Combretaceae		X	X	X

Commelina benghalensis	Commelinaceae		X		
Commelina spp	Commelinaceae			X	X
Crotalaria retusa	Fabaceae	X	X	X	X
Desmodium scorpurius	Fabaceae	X		X	X
Diodia sarmentosa	Rubiaceae		X	X	X
Dioscorea spp	Dioscoreaceae			X	X
Euphorbia heterophylla	Euphorbiaceae				X
Euphorbia hirta	Euphorbiaceae			X	X
Fleabane conyzatumabensis	Fabaceae	X			
Imperata cylindrica	Poaceae	X	X	X	X
Indigofera hirsuta	Fabaceae			X	X
Ludwig decurens	Onagraceae		X		
Manihot esculentus	Euphorbiaceae	X	X	X	X
Mimosa pudica	Fabaceae		X	X	X
Paspalum vaginatum	Poaceae	X	X		X
Phyllanthus amarus	Euphorbiaceae		X		
Schrankia spp	Fabaceae		X		
Sida acuta	Malvaceae			x	X
Smilax anceps wiid	Simlaceae	X			
Solanum torvum	Solanaceae		X		
Unknown spp A	Asteraceae	X	X		
Vernonia amgydalina	Asteraceae		X		

X represents plant species present in the sampled transects.

ABOVE GROUND SPECIES ABUNDANCE OF ABANDONED FARMLAND, AROUND UNIZIK.

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SEED BANK ABUNDANCE STATUS OF THE ABANDONED FARMLAND, UNIZIK.

Results of the seed bank abundance status of abandoned farmland at various depths are shown in Tables 2b, 2c and 2d below.

Table 2b showed that at 0-5 cm depth the seed bank of Unknown species (A) was most abundant than other seed banks followed by *Cyperus rotundus* and *Mariscus flabelliformis*.

Table 2c showed that at 5-10 cm depth the seed bank of *Cyperus rotundus* was most abundant than other seed banks followed by *Mariscus flabelliformis* (25.66) andUnknown species (A).

Table 2d showed that at 10-15 cm depth the seed bank of Unknown species (A) was most abundant than other seed banks, followed by *Digitaria gayana* and *Cyperus esculentus*.

DISCUSSION

In the abandoned farmland, the highest number of emergence was at the 0-5cm which decreased with increasing soil depth. The lowest number of emergence was in 11-15cm depth. This study confirmed Falinska (1999). Several studies including Falinska, (1999) highlighted that seed densities in the soil fluctuates as succession progressed. Also, it was opined that seed bank composition of abandoned pastures floristic composition represents the product species of current vegetation and long term substitutions of species by certain factors such as structure of vegetation which indirectly influences the accumulation of seeds in the soil and such fluctuations decreases with succession (Toledo and Martinez- Ramos, 2011). Also, figures 3 showed that the abandoned farmland second to the highest mean seed density (3.0g/m3) among all the sampled plots at 0-5cm depth. But it had the lowest seed density in the 11-15cm depth.Meanwhile, figure 5 showed that abandoned farmland plot had the highest species emergence at 6-10cm by the Cyperaceae family.This implies that woody species are completely absent from the seed bank. Andreas and Michaela (1999) ststed that plant species decline in population due to abandonment especially in relation to Meadows because the plants due not have persistent seed banks which may be true concerning this study. It therefore worrisome how restoration of the former species can occur in this site.

Middleton (2003) discovered also that woody species including trees, shrubs and vines were poorly represented in the seed bank of farmed and intact soils. Instead herbaceous species were abundantly present in the seed banks. This also agrees with this study since woody species did not make the seed bank species abundance. Middleton (2003) suggested that only few herbaceous species decreased in seed density in the seed bank with time under cultivation although seed densities were at sites that were not farmed.Unfortunately for this research there was no experiment in a similar farmland that was not been abandoned to compare our result because of the limited timing of study and lack of space for the seed bank experiment. Andreas and Michaela, (1999) observed that abandonement has negative effects as it introduces exotic and invasive species which may not be similar with the seed bank. However, in this research study only four (4) plant species were found both in the seed bank and above ground vegetation of the abandoned farmland. The species were *Chromolaena odorata, Ludwig decurrens, Unknown species (A) Asteraceae, and Kyllinga pumila.*(See figure 11).Meanwhile, the above result confirms Tefera, (2011) which revealed that there are variations in the seed bank composition from the above ground species which implies that the seed bank is a poor reflection of the above ground vegetation.

CONCLUSION

This experiment has shown that abandonment of farmland has negative effects on the restoration of piooner species in that particular ecosystem.

REFERENCES

Akobundu, I.O. and Agyakwa, C.W (1998). *A Handbook of West Africa weeds* (2nd ed). International Institute of Tropical Agriculture, Ibadan, Nigeria. pp. *564.*

Ambrosio, L., L.Iglesies, C. Mann and Monte, J.P.D (2007) Evaluation of sampling Methods and Assessment of the sample size to estimate weed seed bank in soil, taking account spatial variability. *Weed Research,* **44:**224- 236.

Anambra state —wilc4edia. http://ehm. wikiedia. org>wiki. Awkci retrieved 16/08/20.

Anderson, T.M., M. Schutz and Risch, A.N (2011) Seed germination clues and the Importance of soil seed bank across an environmental gradient in the Serengeti. *Nordic , Oikos:* 1-7.

Andreas, S and Michaela, Z. (1999) Plant species decline due to abandonment of Meadows cannot be easily reversed by mowing. (A Case Study of Southern Alps). *Journal of vegetation Science*,**10**: 151-161.

Anizoba, M.A, Ebenebe, C.I, and Okeke, J.J (2006) *Basic Ecological Exercises. A student guide to field work and analysis.* SCOA Heritage systems (Educational Publishers), Awka. Anambra state. 79pp.

Arrhenius ,O (1921) Species and area. *J Ecol 9*: 95–99. doi: 10.2307/2255763

Ashrafi, *Z.Y.* (2006) *Effect of tillage and soil type on weed seed bank.* 18th world Congress of soil science, July 9-15, 2006. Tehran University, Agronomy College, Tehran, Iran. 166-288.