

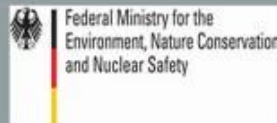


ETHIOPIAN BIODIVERSITY INSTITUTE
BIODIVERSITY AND ECOSYSTEM SERVICES NETWORK (BES-NET) PHASE II PROJECT
ETHIOPIAN POLLINATORS CONSERVATION



OUTREACH MATERIAL FOR SCHOOL CHILDRENS, FARMERS, AGRICULTURAL
EXTENSION AGENTS AND OTHER LAND USERS

MAY, 2024



Ethiopian Biodiversity Institute
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**May 2024
Addis Ababa**

Introduction

Pollinator services are essential for the production of many crops in Ethiopia, including the plants that support people's food, nutrition, and economic security, including guarantee of the production of coffee which is the economic back bone of the country. Fruit, vegetable or seed production from 87 of the 115 leading global food crops depends upon animal pollination. Likewise, out of the 53 major agricultural crops cultivated in Ethiopia, 33 of them (62.2%) are dependent on biological pollinators, and of the total biological pollinators, honeybees contribute 80% of pollination services. Honeybees alone play a central role in agriculture as pollinators, and their contribution to the global economy for food production is estimated between \$ 235 and \$ 285 billion annually and \$0.815 billion in Ethiopia, which is 6.24% of the agricultural GDP. This outreach material is mainly prepared for students, agricultural extension agents, and farmers for making them aware of the uses and protection of pollinator's loss

Pollination&Pollinators

Pollination is defined as the transfer of pollen from the male reproductive part of a plant to the female. It occurs when the pollen is moved within same flower or between two flowers of a single plant (self-pollination), or between two flowers found on two individual plants of same species (cross-Pollination).

Q. Do you think that pollen grains are mobile by themselves?

How do pollen grains move?

Pollen grains are immobile by themselves thus require pollinators, pollen vectors or pollinating agents to move them from the male part of a flower to the female part of a flower in Angiosperms, or from male cone to the female cone in Gymnosperms.

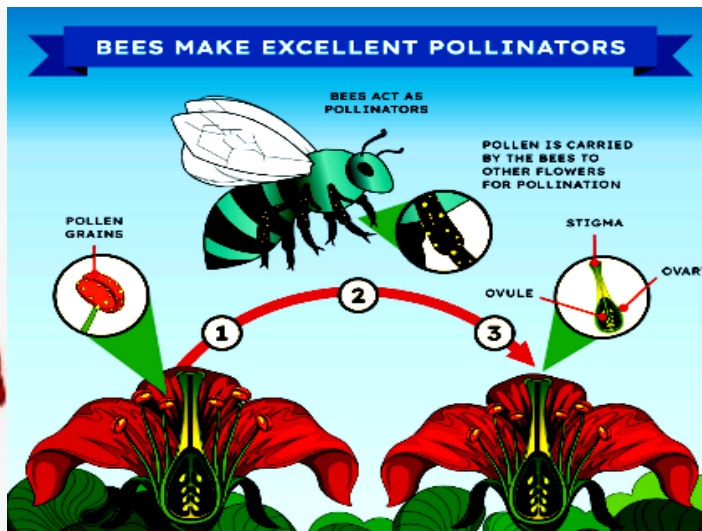
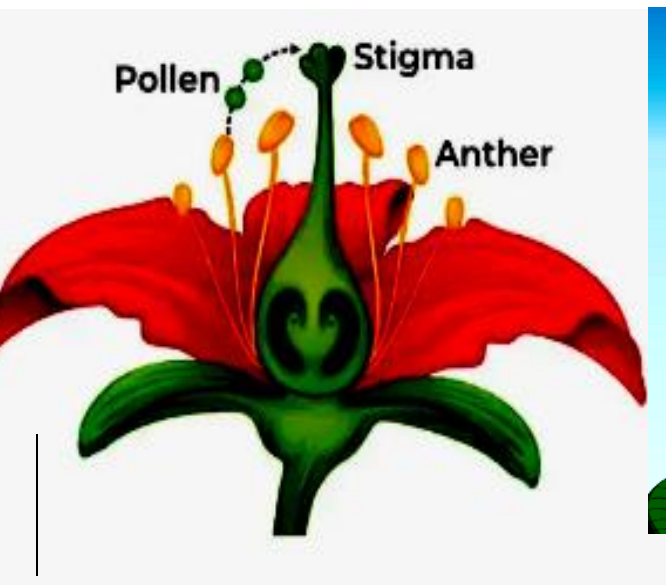


Figure 1 A. Self pollination

B. Cross Pollination

Pollinator diversity

Pollinators comprise of highly diverse groups of animals globally which transfer pollen in seed plants (Ollerton, 2017).

Table 1. Representative groups of major pollinators across the globe

Genera	Some groups	Numbers
Lepidoptera	Butterfly, moth etc..	~180,000 spp
Coleoptera	Beetles etc..	~380,000 spp
Hymenoptera	Bee, ants, wasps etc	~150,000 spp
Diptera& Thysanoptera	Flies, Thrips etc	Least groups serve in pollination
Birds	Humming bird, Tacazze sun bird	~2000 species
Reptiles, rodents, lemurs & marsupials		Contribute to pollination but attract relatively low attention as compared to other pollinators such as bees and butterflies

Q. Do you know some pollinators from your surrounding?

Biotic and abiotic pollinators

Pollinators can be grouped as biotic and abiotic. The biotic pollinators include insects, birds, bats, lizards, human beings, and other animals. While the abiotic ones include wind and water. About 80% of all plants are pollinated by biotic pollination



Bee



Butterfly



Humming bird



Beetle



Bat

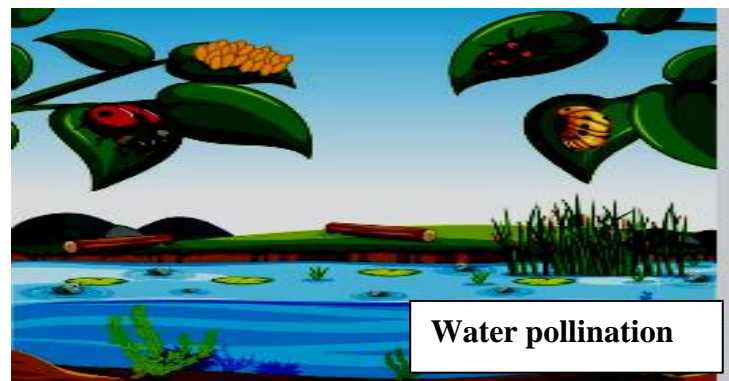


Wasps

Abiotic pollinators



Wind pollination



Water pollination

Figure 2. Biotic and Abiotic pollinators

Q. Why do biotic pollinators visit and interact with plants?

Biotic pollinators interact and visit plants to get two main substances.

- 1. Nectar-** very sweet sugar-rich liquid produced by plants in glands called nectaries or nectarines. Nectaries are usually located at the base of stamens of a flower, which draw biotic pollinators into contact with the pollen to be transferred. In Most cases nectar remains on the nectary until utilised, but many examples of secondary nectar receptacles are known, generally in the shape of long spurs into which the nectar runs.

Nectar secretion is to a large extent dependent on the physiological state of the plant. However it is important to note that even in healthy well-nourished plants nectar production shows a more or less pronounced rhythm, corresponding to the periodicity of the pollination process. Most flowers secrete only relatively small amounts of nectar, which encourages cross-pollination, since animals must visit several flowers in order to receive a full meal. The sugar content of nectars varies between 8 to 75 %. Also contains pure carbohydrate solution, some lipids and amino acids.



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Q. Have you ever drunk a coffee?

Continual supply of Ethiopian coffee (the backbone of Ethiopian economy) demands continuous survival of pollinators like honeybees. No honeybees means, no pollination, no pollination means no seed formation, and hence no coffee at all. Is it not amazing!



Figure 4. Coffee production, the backbone of Ethiopia economy, relies on pollinators

Q. Have you ever seen Nectar feeding pollinator around your school garden or village?

The most common Nectar consuming pollinators include Bees, Butterflies, Bats, Moths, Hummingbirds, hoverflies and wasps.

2. Pollen: -A powdery substance produced by most types of flowers of seed plants for the purpose of sexual reproduction. Pollen is a rich source of food, especially of proteins for biotic pollinators. Analysis of pollen indicates presence of 16-30% protein, 1-7% starch, 0-15% sugars, 3-10% fat, and 1-9% ash contents.



Figure 5(A). A bee full of pollen on its body hair (B).A pollinator butterfly sucking nectar from flower

Plants dependence on animal pollinators for seed production

The great majority (87.5%) of flowering plants are adapted for pollination by animals, with the remaining of species being either wind-pollinated or completely reliant on autonomous seed production. The availability of effective pollinators in plant communities is an obvious requirement for successful seed production in most plant species. In a global meta-analysis, an average 63% loss of fruit or seed production is evident when vertebrate pollinators are excluded from the flowering plants they visit.

What should school children do to keep animal pollinators?



Q. Why should we care about pollinators?

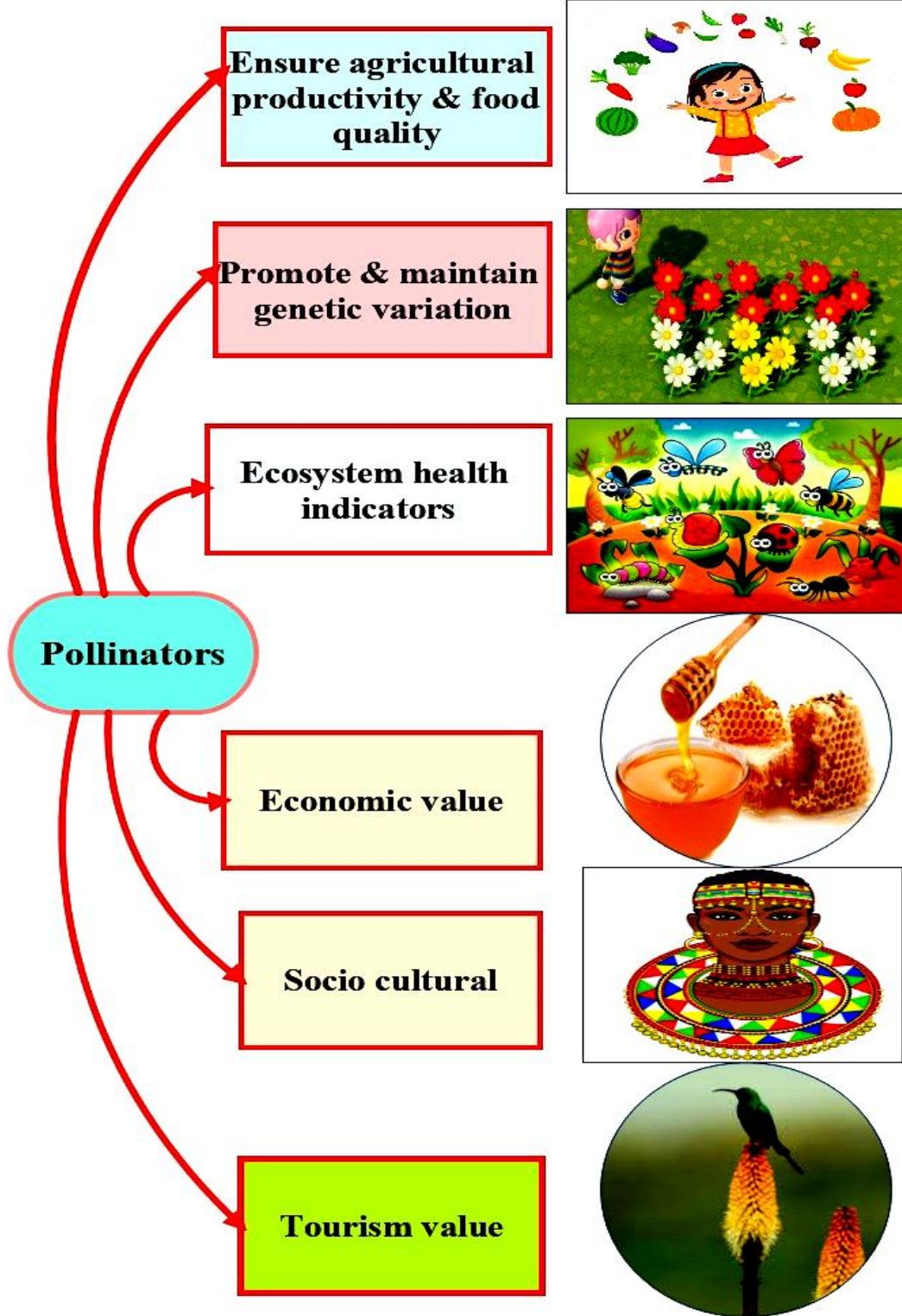


Figure 6. Major uses of Pollinators

Q. What is the status of pollinators?

Globally, 16.5% of pollinators are threatened and over 40% of pollinator species are facing extinction. From these more than 23 insect pollinator species have recently become extinct (NRC, 2007), and more than 34 pollinator species are endangered in the U.S alone(USFWS, 2007). Today, there is strong evidence of a decline in the abundance and diversity of pollinators, particularly bees, butterflies, bats and hummingbirds. Widespread reports indicate that pollinators are declining persistently. The reality is similar in Ethiopia despite lack of detailed pollinator status study across the country.

A lack of global Red List assessments specifically for insect pollinators and, in most parts of the world including Ethiopia, the limited long term population data or benchmark data on insect pollinators to compare the present status of wild pollinator populations makes it difficult to discern any temporal trend. According to the Birdlife International on State of the World’s Birds: 2022 Annual report, regarding bird in Ethiopia, there are 821 total numbers of bird species, of which 36 species are globally threatened, 7 species are critically endangered, 14 species are endangered, 15 species are vulnerable, 26 species are near threatened, 755 species are least concern. However, there is no consolidated data about the status of Ethiopian pollinator birds.

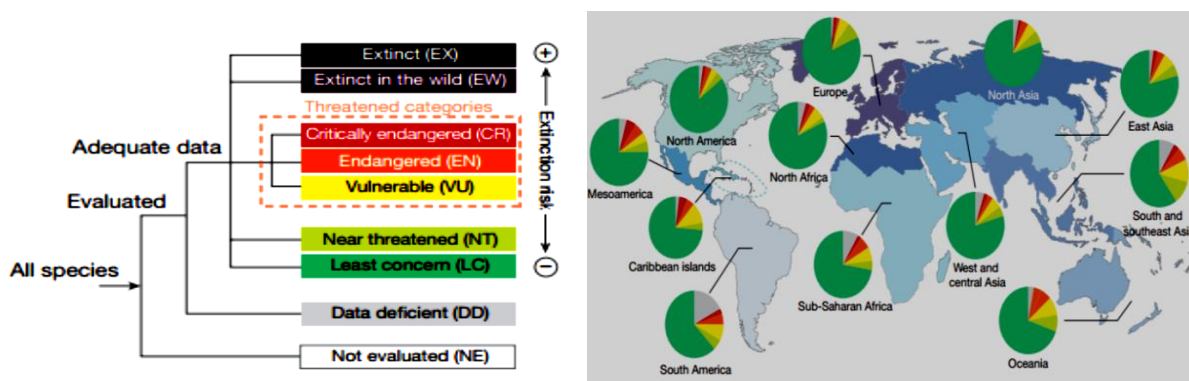


Figure 7. IUCN red list status of vertebrate’s pollinators across regions(NRC, 2007)

Q. Why do pollinators decline?

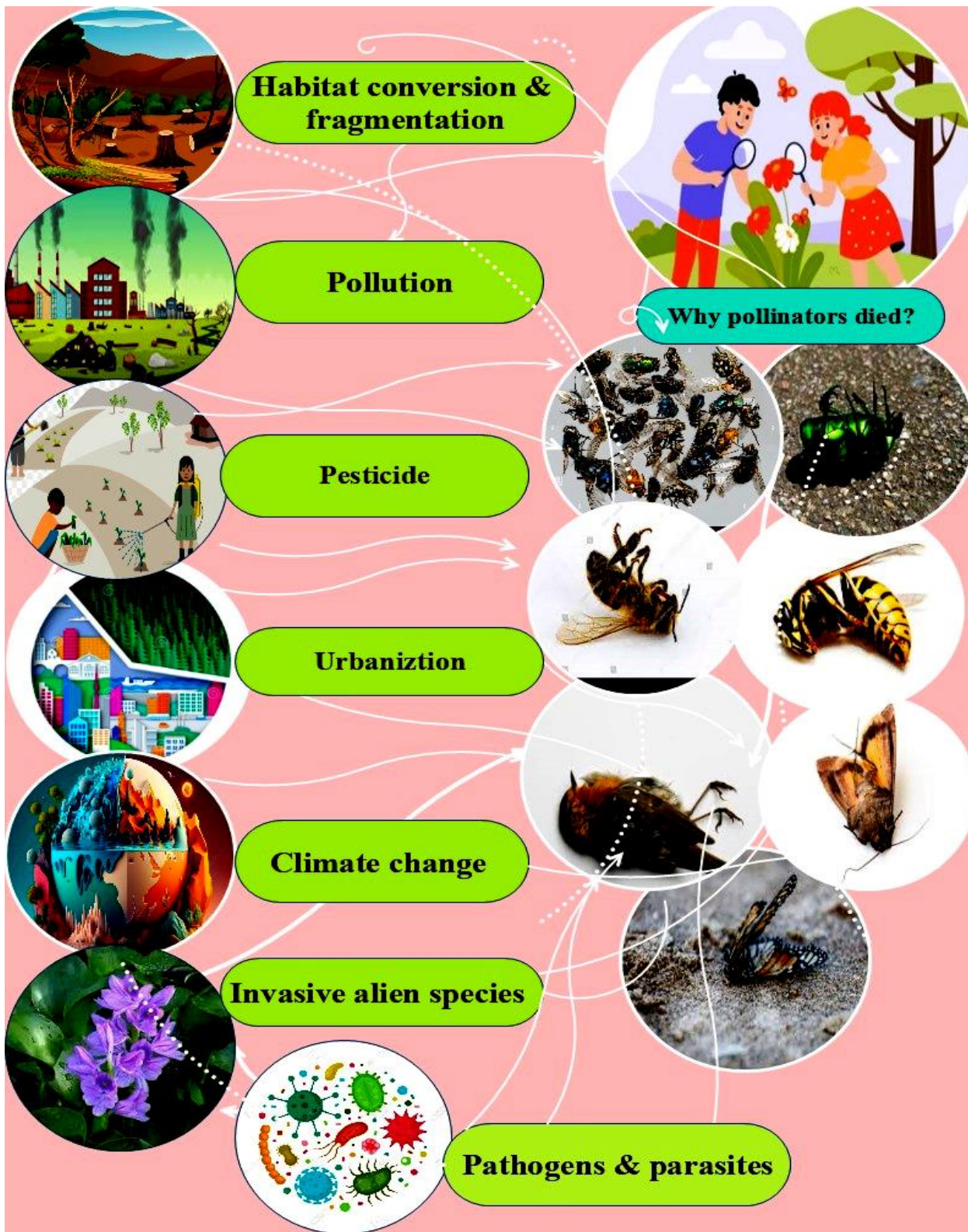


Figure 8. Major causes for decline of pollinators

Q. How do we protect pollinators?

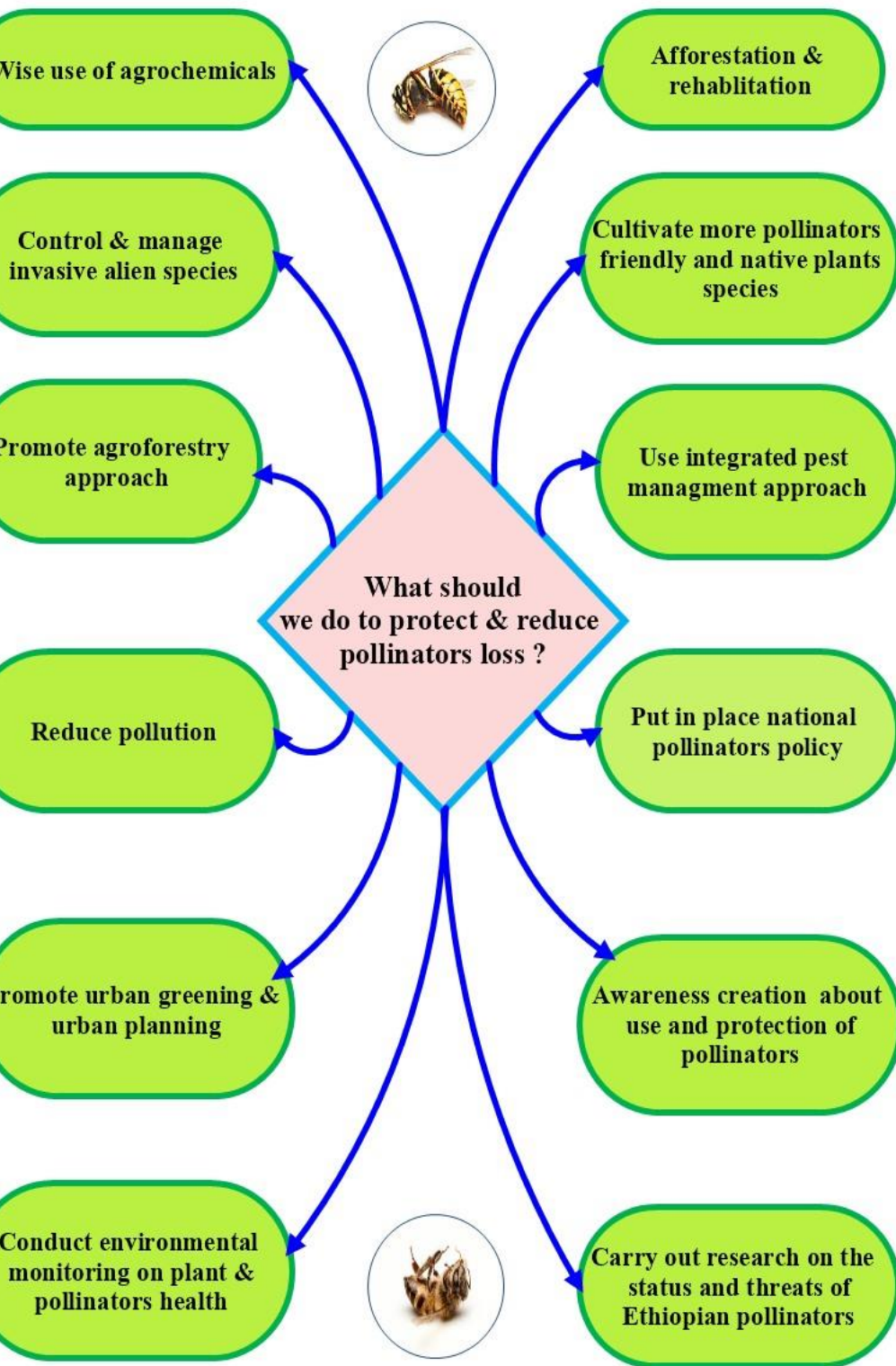


Figure 9. Major approaches to protect pollinators

References

- Alebachew, G. W. (2018). Economic value of pollination service of agricultural crops in Ethiopia: biological pollinators. *Journal of apicultural science*, 62(2), 265-273.
- Bird Life International(2022). State of the World's Birds: 2022 Annual Update
- Klein, A. M. et al. (2007). Importance of pollinators in changing landscapes for world crops. *Proc. R. Soc.* 274, 303–313.
- National Research Council (NRC) (2007). Status of pollinators in North America. National Academies Press.
- Ollerton J, Winfree R, Tarrant S(2011). How many flowering plants are pollinated by animals? *Oikos*. 120, 321-326.
- Ollerton,J.(2017)Pollinator diversity: distribution, ecological function, and conservation *Annu. Rev. Ecol. Evol. Syst.* 48, 353-376.
- Ratto, F., Simmons, B. I., Spake, R., Zamora-Gutierrez, V., MacDonald, M. A., Merriman, J. C & Dicks, L. V. (2018). Global importance of vertebrate pollinators for plant reproductive success: a meta-analysis. *Frontiers in Ecology and the Environment*. 16(2), 82-90.