Progression in understanding systems concepts

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In this progression, we have illustrated the stages identified by Assaraf and Orion with reference to ecosystems:

1. **Naming parts and processes**
   Children can name both living (e.g., specific plants and animals) and non-living (e.g., rocks, water) parts of an ecosystem. They may also name some processes such as feeding, weather activity and so on.
2. **Identifying processes that create relationships between parts**
   Feeding relationships are probably the simplest beginning point – e.g., "caterpillars eat cabbage leaves" in a garden ecosystem.
3. **Building up a framework of relationships**
   Food chains and webs are one type of framework. Nutrient cycles and weather cycles are others.
4. **Making generalisations about relationships**
   Saying that all food chains must start with a plant is an example of a generalisation.
5. **Understanding that some relationships can impact on other relationships**
   Humans can be involved in relationships directly and indirectly – e.g., when they kill caterpillars there is less food for blackbirds in the garden.
6. **Knowing there can be hidden dimensions that affect the system**
   In a garden ecosystem the decomposers are mostly tiny soil animals or invisible bacteria and fungi. They are hidden but without them soil would lose its fertility.
7. **Understanding that many systems go in cycles**
   Decomposers are nature’s recyclers! Nutrient cycles such as the carbon cycle would stop if dead bodies could not be broken down.
8. **Recognising that systems can change over time, sometimes slowly and sometimes quite quickly**
   Students who understand this may be able to predict changes and give reasons for their predictions.

References

Assaraf, O., & Orion, N. (2005). Development of system thinking skills in the context of Earth system education. *Journal of Research in Science Teaching, 42*(5), 518-560.

Resource List

- A flax bush ecosystem
- A native bush ecosystem

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