Changes in biodiversity: are there implications for ecosystem functioning?
Klemens Ekschmidtt

Do species rich communities provide better services than species poor communities? Klemens detailed four hypotheses.

| Effect type/hypothesis number (see below) | Species richness effect? | | |
|---|---|---|---|
| | No | Yes | Scale dependent? |
| 1. Asynchrony and ideal distribution theory | Motile organisms | Sessile organisms | Spacial? |
| 2. Competition theory | Species rich | Species poor | Transitory in time |
| 3. Spare wheel and Ecophysiology | Different tollerences | Organisms with no decoupling between reproduction and activity | |
| 4. Functional synergy | Processes that underlie flow equilibrium | Non-equilibrium processes | Transitory in time |

Hypothesis 1 – Asynchrony. Example was 2 nematode populations whose niches were separate, therefore covering all available resources. And… Ideal free distribution theory – there is a limited habitat quality that organisms will accept, an organism will relocate to get the best habitat possible. This is not species related, just relates to total abundance. Limited by spatial movement (ie wouldn't work for sessile organisms).
Hypothesis 2 - In a species rich community you get more complete resource use, which is better overall for the whole community. Competition theory – if competition lessons species increase their niche size, but this is only possible with a large fundamental niche.
Hypothesis 3a) Spare wheel - Even when environmental factor drops dramatically, you still have some species able to still survive. 3b) Ecophysiology – tolerance ranges of different activities are nested hierarchically, ie within a range of conditions an organism will survive, be active and reproduce; under a broader, less favourable set of conditions the organism will be active and survive, but not reproduce. Under even broader and even less favourable conditions the organism will simply survive.
Hypothesis 4 – Functional synergy – like litter decomposition where a selection of organisms are dependent on each other for survival (ie complementary activities/functions). Dynamic equilibrium allows changes in processes to reflect the rate of flow through compartments and can change accordingly, flow does not allow for this if a part of the community is lost.

Expected richness effects…

***Weak***
Motile organisms
Organisms with differing tolerance for reproduction and activity
Higher animals (ie protozoa)
Species rich
Processes that underlie flow equilibrium
Litter decomposition

***Strong***
Sessile organisms
No decoupling between reproduction and activity
Bacteria, fungi and plants
Species poor
Non-equilibrium processes
Primary production and nutrient loss (which are self reinforcing processes)
Large areas and transitory in time

There are no theoretical reasons why biodiversity is essential. Example of mouse food – eating the same pellet type for years, microbial growth on agar. The belief in diversity is strange, theres no better reason why it would be better than uniformity. This led Klemens to the interim conclusion that diversity is only important in a small range of cases.

Experimental testing – range of sites across Europe and looked at nematode species diversity and various soil parameters (soil microflora, plant nutrients and nematode populations – diagram suggested the inclusion of climate and vegetation interactions with the nematode populations). Nematodes are good organisms to study as they have large taxonomic and species diversity. The hypothesis was that increased species richness would increase community "average levels", reduce spatial and temporal variation and extend the micro-niche.

Increased richness of feeding types was observed with increasing nematode richness. When nematode richness was plotted against soil water and soil temperate (including data from all the sites) the site with the mid-range of both had the greatest species richness. However, when the cross correlation between species richness and individual biomass was taken into account there was no evidence of a species richness effect in the nematodes. Habitat utilisation graphs showed that nematodes operate over a range of humidity and temperature levels.

Other examples in published papers…
**Salonis et al, 1981**. Serial dilution of soil in water. The greater the dilution the less $O_2$ was consumed. **Van de Heijden et al, 1998**. Mycorrizae and roots. Increase mycorrizal = increased growth of mycorrhizae and plant growth. Tilman et al, 1996. Increased plant diversity = increased plant cover and decreased nitrate leaching.

Empirical evidence related to hypothesis…
Soil animals = inconsistent
Microbe community = Yes
Plants = Yes
Soil decomposition = variable/rare
Nutrient loss = Yes

**Discussion after the presentation (notes taken as accurately as I could!!)**

Anskar – What is your personal view on biodiversity?
Klemens – You don't need to conserve biodiversity.

Wolfgang – Suggested that Klemens didn't address scale problems with the samples and that he needed to look at the landscape level.
Klemens – the functional mechanistic domain of the nematode is millimetres, making them excellent community to study. They allow you to shrink the dimensions of the study and allow small sample size. Stated that they first observed the effect in the nematode population, then thought up the theory.

Dagmar – Biodiversity is not an indicator of what was studied here. The exciting question is to look at what species do in an ecosystem.
Klemens – could we see the effect of richness in processes that are stable by themselves? ( I think, sorry this may be incorrect)

Marcin – He has studied birds and energy flux. He noted that if a bird disappears theres no effect in the energy flow.
Someone said – what about the interconnecting species?

Marcin – If we loose biodiversity we may loose the potential for say medicines.
Klemens – talked again about the mouse and food pellets.

Anskar – What you are saying is dangerous, its OK to debate it here with other scientists, but what if you spoke to a journalist and they took you message on board completely?

Anne – This is a very emotive and normative approach we are taking to Klemens work, also very emotional, despite him presenting it in a very scientific way. Mentioned cows grazing on grass.

Klemens – he was expecting the results to be the opposite of what he found, and that species richness would improve processes.

Wolfgang – this is a scale effect.

Anskar – there is a psychological basis to our need for biodiversity.

Sophie – Mentioned biodiversity and key species, we don't know which we'll need. If we loose biodiversity then we might loose more. The precautious principle.

Alwyn Sowerby