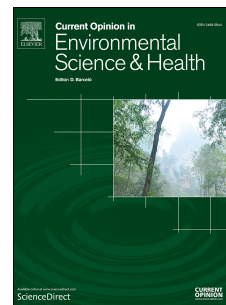


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Vegetation and Soil Degradation in Drylands: Non Linear Feedbacks and Early Warning Signals

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1 Vegetation and Soil Degradation in Drylands: Non Linear Feedbacks and 2 Early Warning Signals

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12 13 **Abstract:**

14 Anthropogenic activities and climate change are imposing an unprecedented pressure on
15 drylands, increasing their vulnerability to desertification. The spatial organization of the
16 sparse vegetation cover is fundamental for the healthy function of the system, and
17 disturbances can trigger cascading feedbacks leading to catastrophic system collapse. Here
18 we discuss some of the latest research aiming at understanding abrupt landscape transitions
19 and possible non-reversible changes, as well as emerging research on the identification of
20 early warning indicators of abrupt transitions to desert states. Robust indicators should take
21 into account temporal system dynamics characteristics, vegetation organization/patch size
22 distribution, functional connectivity measures and human intervention effects.

23 **Highlights:**

24 Dryland vegetation is organized in patterns for improved water capture.

25 Vegetation patterns emerge from nonlinear water-vegetation-soil feedbacks.

26 Perturbations by removal of plant cover can trigger erosion and desertification.

27 Early warning signs can prevent shifts to non-reversible degraded states.

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