

Albedo-induced global warming potentials in context of greenhouse gases in grasslands of East Asia

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Land surface albedo, a fundamental indicator of the Earth's surface energy balance, is credited as a significant warming species after the three dominant greenhouse gases (CO₂, CH₄, N₂O). Both human activities and natural disturbances have substantially and extensively changed the land cover in grasslands of East Asia, which in turn resulted very different values of albedo and GHGs. Unfortunately, there remain limited knowledge on the magnitude, dynamics, and uncertainty magnitude of albedo-induced global warming potential (GWP_a) as well as its relative importance within the context of GHG species, especially in grassland ecosystems. Based on in situ data from eddy covariance (EC) flux towers, static chambers, and satellite images (e.g., MODIS and Landsat) across the drylands in East Asia, we analyzed the long-term changes of GWP_a and its relative values to major GHGs in different grasslands. We also attempted to tease apart the contributions of human influences (i.e., grazed steppe, fenced steppe, and mining) and natural disturbances (e.g., precipitation gradient, drought events) to the changed GWP_a. The benefits of climatic cooling due to elevated albedo as a result of overgrazing or other disturbances is for the first time quantified and discussed. This synthesis research is based on available open access data, which prevents us from generating spatially and temporally continuous GWP_a. We emphasize the importance of GWP_a when assessing ecosystems' overall role in regulating climate for landowners and policy makers.

Keywords: Albedo, Greenhouse gases, grassland, East Asia, human activities, natural disturbances