

GC33F-02: Carbon implications of Virgin Lands Campaign cropland expansion and post-Soviet agricultural land abandonment in Russia and Kazakhstan

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Political economy and institutional changes regarding land use play crucial role in shaping land cover worldwide. Among such events was the Soviet Virgin Lands Campaign, when 45.2 million ha of virgin steppes were ploughed up from 1954 to 1963 in northern Eurasia. We took opportunity to evaluate carbon (C) costs of this Campaign, particularly with the account of massive cropland abandonment in the former Campaign area after demise of the Soviet Union in 1991. Within cropland mask produced with remotely sensed data, we spatially disaggregated historical annual sown area statistics at the provincial level for Russia and Kazakhstan based on cropland suitability assessment. We also adjusted our cropland allocation model with the use of 1:3,000,000 map depicting cropland expansion in Northern Kazakhstan. We used C bookkeeping approach to assess C dynamics based on soil stratification and C field measurements. The Campaign resulted in huge C losses from soils, which accounted for 611 ± 47 Mt C in Russia and 241 ± 11 Mt C in Kazakhstan for upper 0-50 cm soil layer during the first 20 years of cultivation. Such C losses could be compared with C losses due to plowing up the prairies in the mid-1930s in USA. Despite the huge C losses from soils during the Campaign, the total C budget in soils of both countries at national level was positive after 1991 due to sequestered C on abandoned lands, albeit the patterns of C loss during the Campaign and C sink in post-Soviet period differed. The C sink from 1991 to 2010 on abandoned croplands in Russia (45.5Mha) comprised 976 ± 108 Mt C and Kazakhstan (12.9Mha) comprised 240 ± 34 Mt C. However, already ongoing recultivation of abandoned cropland in Kazakhstan and already planned such activities in Russia, can release stored C on abandoned lands. Our study highlights the importance of environmental evaluation of such governmental programs and their alternatives, particularly, since such programs are not rare events in modern land-use history.