Creation of Tree and Shrub Vegetation as a Reserve to Mitigate Climate Warming and Carbon Neutrality in the North Chechen Lowlands

Idris Abdurashidovich Bayrakov
Chechen State University Named After A.A. Kadyrov, Grozny, Russia

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Abstract: Due to the fact that projects to achieve carbon neutrality are being actively promoted all over the world, Russia has not stood aside either. A huge scale of activities is being carried out in the country, including carbon landfills, which will allow us to determine the possibilities for sequestration of carbon by tree and shrub vegetation. It is well known that real carbon neutrality can be achieved only by increasing the area of natural and anthropogenic forest and shrub massifs, this will cripple the absorbing volumes of these geosystems. Besides the fact that they are primarily designed to mitigate or neutralize the effects of global warming at regional levels, forest-climatic projects can also bring invaluable benefits to natural landscapes: the preservation of landscape and biological diversity, soil protection, city-forming and water-regulating functions of the forest area. The purpose of the study is to study the possibility of creating woody and shrubby vegetation in the landscape of the North Chechen Lowland complex to neutralize atmospheric carbon. Research objectives: to conduct studies of anthropogenic and climatogenic changes in landscape complexes; to identify the main species of woody and shrubby plants for afforestation of the semi-desert zone; to develop measures for afforestation and optimization of the natural environment of the semi-desert zone.

1 INTRODUCTION

Everyone is well aware of the role of woody vegetation in mitigating the emerging consequences of actively occurring global climate changes on the planet. Forests are good neutralizers and carbon dioxide doublers. In recent years, the world community has been actively involved in the process of countering the increase in greenhouse gas emissions into the atmosphere, a number of fundamental documents have been reached, such as the Paris Agreement, an agreement under the UN Framework Convention on Climate Change regulating measures to reduce carbon dioxide in the atmosphere from 2020. 193 States joined the Agreement, which was adopted instead of the Kyoto Protocol. Climate change as a sum of regional changes has gone far beyond the borders of states and no state alone can solve the problem, this is the case when consensus is needed at all levels of government, active international cooperation in the transition to a "green economy".

Taking into account the above, we have devoted our work to one of the most problematic topics of rational nature management in the forest sector, measures for the artificial construction of forests in the most arid natural-territorial complex of the Chechen Republic, the semi-desert zone, taking into account the possibilities of tree and shrub vegetation to reduce the effects of the effects of climate warming. Forests are among the main carbon neutralizers from the atmosphere and as such their role is exceptionally great in the carbon cycle in nature(Bayrakov, 2008)

In recent years, there has literally been a flurry of scientific publications, both Russian and foreign, on the topic of climate change and the consequences that accompany it, which note the potential for large-scale afforestation of treeless spaces and, naturally, to mitigate the effects of climate change.

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2 MATERIALS AND METHODS

There are many estimated standards for the potential reduction of carbon dioxide emissions due to forested areas. In the semi-desert zone of the Chechen Republic, there is a huge potential for afforestation of more than 50-70 thousand hectares of territory out of 370 thousand hectares of the total area of the arid zone. However, there are many obstacles to active afforestation, there is no necessary technical infrastructure, human resources and management structure for the implementation of such measures on tens of thousands of hectares. At the same time, there is some experience in afforestation of sandy massifs of the semi-desert zone in the Soviet period to create soil-protective and wind-breaking forest strips. A material base was created, several forestry enterprises were organized, which grew planting material, planting and caring for them. However, the long-term lack of care and new plantings, these plantings are in terrible condition, many have died.

Our field studies have shown that using the past experience of creating forest strips, it is possible to create a large forest area in the arid zone of the Chechen Republic within a few years to neutralize atmospheric carbon. But to do this, it is necessary to restore the entire material and technical base with certain scientific and practical tasks - forest-climatic projects.

Naturally, in the current situation, it is necessary in scientific and government structures to radically change the approach to minimizing the consequences of climate change. The experience of many countries has shown that afforestation of treeless territories, and the potential of the Chechen Republic is huge, forest cover is less than 20% of the area of the region, and the semi-desert zone is 99% devoid of woody vegetation, an event that successfully neutralizes atmospheric carbon dioxide. Evaluating all the foreign experience in afforestation of treeless territories, this is not enough, since the result, even if all the measures under the afforestation program are implemented, will be visible at best in 10-15 years (A.D Gozhev, 1930).

The main method was field research by routes that ran from south to north, the reference points were located at the corners of squares with sides of 5 km. Dozens of photographs of sandy landforms were taken (fig. 1).

The basis for further research of the Aeolian landscape complex has been laid. The complex nature of our research allowed us to determine that the main factor that provoked deflationary processes here is the anthropogenic factor, since the second half of the last century, the process of intensive warming began, which naturally intensified deflationary processes.

3 RESULTS AND DISCUSSION

A significant variety of geomorphological conditions and a large elevation difference above ocean level, the location at a great distance from sea currents and the barrier role of the Greater Caucasus caused climatic diversity in the territory of the North Chechen Lowland, despite the relatively small territory. It is a zone with extremely arid climatic

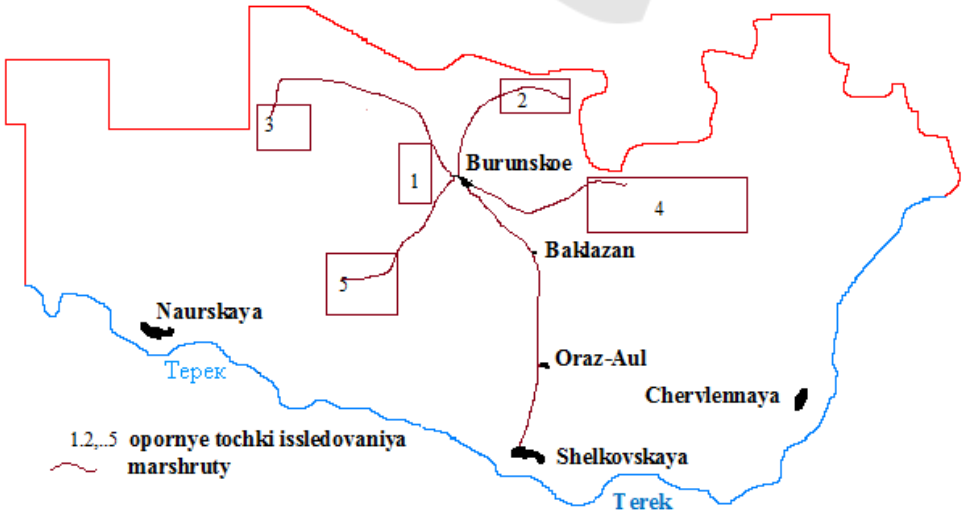

Figure 1: Map diagram agroinvestigationisitineribus North. Chechen campestribus.

conditions and occupies the territory in the extreme north-east of the Chechen Republic. The zone is characterized by extreme aridity, here the annual precipitation is no more than 300 mm, and in some years the amount of precipitation does not reach 200 mm per year (Dzh. G Kanadell, E`. D iShul`ce, 2014).

The warm period is quite long, as well as throughout the Eastern Caucasus, but the period when the average daily temperature is above 20^0 C in the zone exceeds the rest of the region for about a month. Winter and autumn periods are much milder here, with an average temperature of - 2.2^0 C in January and +26.5^0 C in July.Precipitation is characterized by a strongly pronounced maximum in September. The zone is characterized by a rather unstable snow cover, which is often blown away by the wind. The zone with arid climatic conditions is characteristic of the North Chechen lowland.

The presence here of a significant area of open and sparse vegetation of sand masses naturally affects meteorological elements such as precipitation and their redistribution within the zone itself, and it also has a strong effect on summer temperatures C (A. I. Belyaev, K. N. Kulik , A. S.Manaenkov, 2021).

The temperature regime of the coldest month of January is 3^0 C, and the warmest month of July is +25^0 C, with an average annual temperature of +11^0.

The nature of precipitation with a September maximum, like the previous zone, is less than 350 mm, but in some years they are no more than 200 mm, which brings these two zones closer. The maximum amount of precipitation falls in the autumn and spring periods (table 1) (fig.2).

The temperature regime is distributed as follows: the warmest month is January with average temperatures - 4-4.5^0 C, and the warmest month is July with average temperatures +23^0- 24^0 C (fig.3).

In the zone, the distribution of the temperature regime is affected by a relative increase above ocean level, which causes some diversity in different parts of the plain. So the temperature regime in the average monthly indicators ranges from +24^0 C to 22^0 C, for three months the temperature is kept at +20^0 C (fig.4).

Zones on the territory of the North Chechen lowland change from north to south according to the scheme: from semi-deserts, steppes and forest-steppe on the plain. Before the economic intervention of man, the North Chechen lowland was occupied by the Tipchakov-kovyl steppe, today it is completely plowed and there is almost no virgin steppe, except in lands inconvenient for cultivation (G.-Dzh. Nabuurs, P.Delakot, D Ellison, M. Xanevinkel, Xetemaki, L. I. Lindner, 2017).

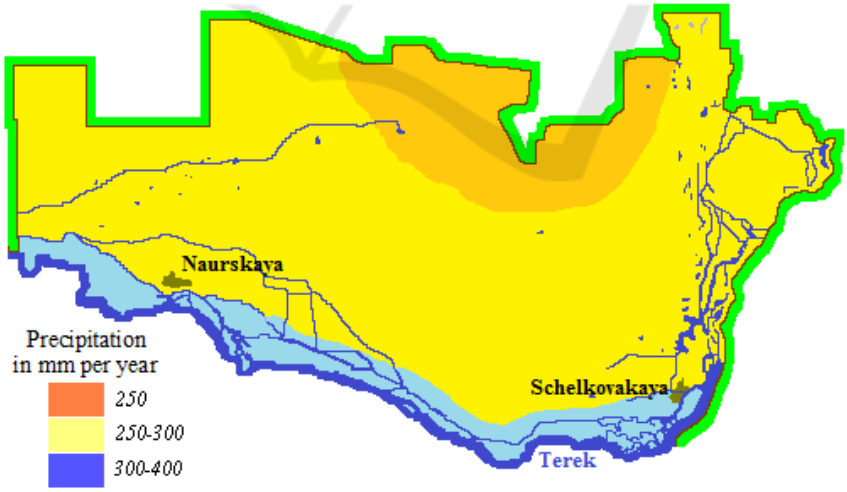

Figure 2: Climate map of the North Chechen Lowland. Chechen campestribus.

Table 1: Average monthly and annual air temperatures.

Weather station	1	2	3	4	5	6	7	8	9	10	11	12	Year
Kargalinovskaya	19	16	15	24	28	36	30	26	30	19	24	24	291
Naurskaya	18	17	22	27	46	56	41	31	26	30	31	24	369

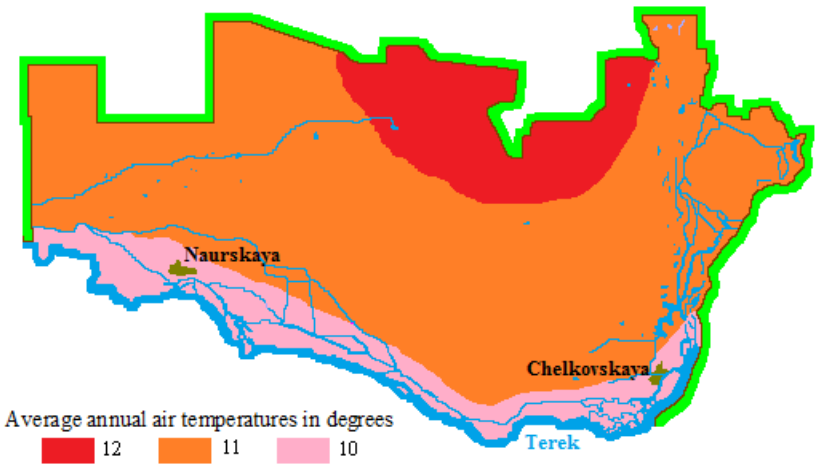

Figure 3: Climate. Distribution of average annual air temperatures. Chechen campestribus.

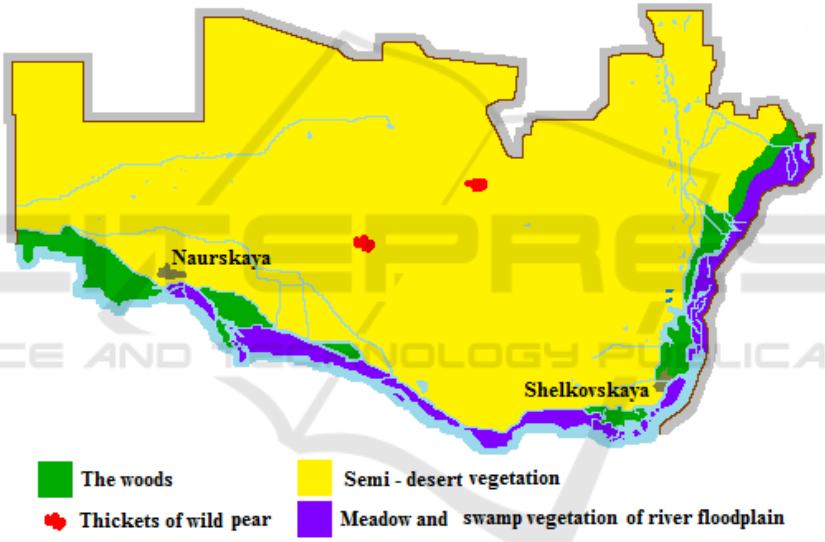

Figure 4: Vegetation map of the North Chechen Lowland. Chechen campestribus.

In the floodplain part of the river there is a floodplain forest. Tipchak-kovyl steppe associations of plant communities have spread mainly on sandy loam and light loam-based chestnut soils of the plain, and on the adjacent valley of the Terek River.

The territory of the North Chechen lowland is almost completely devoid of natural vegetation. According to (Rozhanecz-Kucherovskaya, 1925), and then it was noted by (Gozhev, 1930), that the indigenous plant associations on the plain were tipchak-kovylnye.

If we trace the history of the development of the vegetation cover of the plain, then we can restore the course of restoration to its original state according to the following scheme: at the first stage, the arable land is overgrown with associations of wormwood, which also includes other species: porcine, roofing and splayed bonfire, larkspur, bunny, milkweed and field bindweed(Yu. Pan, R.A. Betdsi, Z., Fang, R. Xiong, P.E. Kauppi, V.A. Kurcz, 2011).

This group of plants in this composition develops within 5-10 years; The final stage of the restoration process creates a tipchak-kovyl steppe in the North Chechen lowland consisting of tipchak, hair-shaped feather grass, sea wormwood, prostrate kohia, combed wheatgrass, noble yarrow and tamarisk.

The vegetation cover of the territory along the canal differs significantly, as a result of the infiltration of the canal waters, meadow formations have formed here, creating dense thickets with a

predominance of meadow-steppe grasses with a variety of cereals: creeping wheatgrass, meadow bluegrass, thin-legged, timothy, Siberian wheatgrass, as well as alfalfa and gunba make these meadows highly valuable in terms of fodder.

Semi-desert landscape complexes of the North Chechen lowland are represented by three types: sharply continental Kazakhstan with the sum of annual active temperatures of 3600^0 C and annual precipitation of 200-300 mm, extremely continental climate with the sum of annual temperatures of 4200 ° C and precipitation of 100-200 mm.

Atmospheric surface runoff is practically absent, weathering, deflation, and salinization occur actively in the north-east of the lowlands. Phytomass reserves - 8-4 t/ha, productivity - from 3 to 5 t/ha. Stable snow cover is not preserved (A.I. Belyaev, K. N. Kulik, A. S.Manaenkov, 2021).

During the snowless period, there is a lack of moisture in the soil. The distribution of soil and vegetation cover is characterized by complexity, i.e. continuous change of different subtypes of soils and plant groupings, due to meso- and microrelief, - a large number of suffusion depressions. Allthedepressionsarecoveredwithvegetation(A.I. Galushko, 1975).

List of plants used in forest reclamation of pastures (A.I. Galushko, 1978-1980; A.A. Grossheim. 1948).

Trees

1. *Armeniaca vulgaris Lam.*
2. *PrumusdivaricataLedeb.*
3. *Ailanthus altissima (Mill.) Swingle.*
4. *Betulapendula Roth.*
5. *Ulmuspumila L.*
6. *Ulmuslaevis Pall.*
7. *Pyruscommunis L.*
8. *Acer platanoides L.*
9. *Acer campestre L.*
10. *Acer tataricum L.*
11. *Acer negundo L.*
12. *LarixsibiricaLedeb.*
13. *Robiniapseudoacacia L.*
14. *Haloxylonpersicum Bunge*
15. *Haloxylonaphyllum (Minkw.) Iljin*
16. *Pinuspallasiana D. Don.*
17. *Pinussilvestris L.*
18. *Populusalba L.*
19. *Populusbalsamifera L.*
20. *PopuluslaurifoliaLedeb.*
21. *PopulusdiversifoliaSchrenk.*
22. *PopulusbalsamiferaL.(var. sibirica)*
23. *Populusnigra L.*
24. *Morusalba L.*
25. *Maluspallasiana Jus.*
26. *Fraxinuslanceolata*

Shrubs

27. *Caraganaarborescena Lam.*
28. *JuniperuscommunisOblongaPendula*
29. *Crataegussanguinea Pall.*
30. *CalligonumaphyllumGurke.*
31. *CalligonummicrocarpumBorszcz.*
32. *Calligonum caput-medusaeSchrenk.*
33. *Calligonumsetosum (Litv.) Litv.*
34. *Loniceratatarica L.*
35. *Salix daphnoidesVill.*
36. *Salix caspica Pall.*
37. *Salix rubraHuds.*
38. *Amelanchierrotundifolia (Lam.) Dum. Cours.*
39. *Elaeagnusangustifolia L.*
40. *Hippophaerhamnoides L.*
41. *CotinuscoggygriaScop.*
42. *RibesaureumPursh.*
43. *TamarixramosissimaLedeb.*
44. *TamarixlaxaWilld.*
45. *Ephedra distachya L.*
46. *Halimodendronhalodendron (Pall.)*
47. *SalsolapaletskianaLitr.*
48. *Salsolarichteri (Moq.) Kar.exLitv.*
49. *Aelleniasubaphylla (C. A. Mey) Aell.*

4 CONCLUSION

Carrying out all types of processing of agricultural land along transverse slopes with successful measures to protect land from flushing in such farming conditions, contour organizations of arable land are more acceptable.

Planting regulating the flow of forest belts allows it to switch to contour-reclamation land use systems using all necessary anti-erosion measures that resist the development of the erosion process. The simplest and cheapest method that protects arable land from floods and downpours are buffer forest belts, their construction does not require special techniques and serious changes in agricultural technology to cultivate crops.

They are built on slope complexes, the steepness of which is more than 2^0. Their creation is desirable from crops with continuous sowing (perennial and annual grasses, winter, spring grains). Buffer forest belts are used in order to restrain the flow of snowmelt water masses on winter crops in winter and spring periods.

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