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From Mountain Slopes to Thriving Fields: Building Sustainable Agriculture in Tajikistan

Imagine living in a country of 10.8 million people where only 5% of the soil nationally is suitable for agricultural production, often due to soil degradation and land erosion, while having to import roughly 50% of the national food supply and having the majority of arable land unusable from overgrazing (International Atomic Energy Agency [IAEA], 2022). Unfortunately, this is the reality for those living in Tajikistan. A former Soviet state, Tajikistan claimed independence from the USSR in 1991, but this was immediately followed by a civil war from 1992 to 1997. Following the civil war, Tajikistan has faced severe poverty but has been on an uptrend in recent years; however, with 6.13% of the population still living on less than $3.00 a day and an uneven political climate across the region, humanitarian aid is still needed for much of the country (British Broadcasting Corporation, 2024). This has led to an agricultural crisis not seen before in Central Asia.

Agriculture is often considered the backbone of Tajik culture. With 4.6 million hectares and the potential for 1.76 million hectares suitable for irrigated land, it is assumed that the nation would be a powerhouse in Central Asia. However, most of the land is at high elevations unsuitable for agricultural production, with current estimations putting roughly 93% of the national land as mountainous; with over-farming along these mountain slopes, an estimated 5-7% of the soil nationally is usable for agricultural production (FAO Family Farming Knowledge Platform, 2024). The agricultural sector is a 70/30 split, with 70% for crop production and the other 30% for animal husbandry, with the main crop production being from fruit production of mulberry, melons, and apples. In contrast, animal husbandry is mainly supported by poultry and cattle production (International Trade Administration, 2026). These crops are typical of a small family-style farm. Still, the national crop with high production is cotton, with the national export totaling 106,900 tons, which is a sharp decline from previous generations of Tajiks, with the cause coming from a slew of environmental issues, including abnormal rainfall, extreme summer heat, and the economic factor of a major loss of cotton production professionals (Ismailov, 2025). The farming plot structures in Tajikistan are based on the systems in place when the nation was a Soviet state. The three major plot kinds are the Household plots, which are privatized, family-owned plots often 0.1 hectares and account for roughly 94% of the national plot structure, Presidential plots, which are plots roughly 0.12 hectares large and were given in 2 separate presidential decrees in 1995 and 1997 from an allotment of 75,000 hectares of formerly owned government lands accounting for anywhere between 20-70% of the plots depending on the province, and Dehkan farms, which are government owned plots of land roughly 20 hectares large with the land being retained by the state and farmers owning land-use permits (IFPRI CGIAR, 2024).

In Tajikistan, large, multigenerational families are prevalent. The average fertility rate is 3.1 births per woman. As a result, children under 15 comprise 36% of the population, while 60% are aged 15-64, making Tajikistan one of the youngest countries globally (United Nations Population Fund, 2024). The infant mortality rate is 23.34 per 1000 live births, while the under-5 mortality rate is 27.89 per 1000 live births (UN Inter-agency Group for Child Mortality Estimation, 2023). These figures highlight a critical window of vulnerability; nearly 85% of all under-five deaths in Tajikistan occur before a child's first birthday, often due to neonatal conditions that are exacerbated by the mother's poor nutritional status during pregnancy. The household structure in Tajikistan is patriarchal, with the husband making most of the familial decisions. In rural areas, women are primarily homemakers, while in the capital city of Dushanbe, they are often found working (Pan Atlantic Foundation, 2021). This is, however, changing with an increase in the emigration of husbands and males to Russia, with over a million estimated to travel seasonally, causing a feminization of the home and increasing female participation in agricultural sectors (Integral Human Development, 2024). It is also common for children not to stay with their parents but instead to stay with their grandparents or relatives due to an increase as well in female emigration out of Tajikistan.

Tajikistan faces a common issue for the former Soviet-era states: great potential, but a system not sustainable in the long term, with a major issue relating to soil erosion and degradation. While many projects are ongoing to aid in the overall revitalization of Tajik agriculture, these programs are not focused on smallholder farms, with an estimated $100 million in foreign aid going toward large-scale agriculture revitalization, even though 90% of the national agricultural sector is held in small-scale agriculture (Food and Agriculture Organization, 2020). Amid a long-standing tradition of small farms working within a 0.2-hectare figure, the need for sustainable agriculture is evident across the country. This concern is exacerbated by a recent study from the United Nations Environment Programme showing that, out of all countries in Central Asia, Tajikistan is the most concerning to have a large-scale impact due to the global effects of climate change likely leading to severe loss in food production and overall agricultural capabilities (United Nations Environment Programme, 2025).

Tajikistan’s soil erosion and degradation are a result of complex historical, systemic, and geographical factors. The main driver of soil degradation is the continuation of Soviet era agricultural practices. For context, Tajikistan, when it was a Soviet state, was primarily an agricultural state designed for the monoculture of cotton, going to extreme lengths to increase national production. These extreme measures included repeated use of organochlorine pesticides (OCPs), which are banned in most countries due to their known carcinogenic effects and long-term impacts on the environment and human development. These chemicals were used right up until 1980, with chemical burial occurring from 1973 to 1991. Research done in the areas of Tajikistan where these pesticides were used and buried has shown an extreme effect on overall soil health, with the chemicals still being found in the surrounding soils and waterways, with toxic residues of HCH and DDT present in soil samples (Toichuyev, 2020). Compounding the effects of monoculture stripping away soil nutrients and chemical use destroying waterways and overall soil health, the increase in animal husbandry has increased problems in overall soil health.

Beyond the legacy of chemical use and nutrient-depleting monoculture in Tajikistan, expanding animal husbandry has introduced physical changes to the soil environment. Since 2000, animal husbandry has increased as a field very steadily; however, the country's soil quality has continued to decline during this time due to overgrazing and increased mountain-based animal holding areas. Overgrazing becomes an issue due to a lack of feed and active forage for livestock to feed upon, causing a two-step problem: forage is depleted, which leads to a loss of cover cropping for the soil, leading to soil loss and eventual desertification (Hisoriev et al., 2016). The new areas with animal holdings are causing an increase in the use of goats and sheep in mountain areas, and with increased pressures in these areas, soil is loosening and breaking down further. This process of both chemical and biological degradation has led to new reports from the Food and Agriculture Organization that now place over 70% of arable land as degraded or showing visible signs of desertification, while 97.7% of lands are suffering from some kind of soil erosion with a staggering increase of 17.4% to 22.4% of the country being degraded or 10% of the total population living in degraded soil areas (Norov, 2025).

To reverse the trajectory of severe soil erosion and degradation in Tajikistan while safeguarding the limited food resources, an agroecological approach tailored to the 0.1- 0.2-hectare scale is the most effective way to combat the problem head-on. I would propose an integrated design using trees, specifically the Russian Olive and Walnut varieties, while using leguminous seasonal cover crops to help tackle soil degradation from biological, physical, and socioeconomic angles. The way this system would work is through a 4-phase plan without needing extra funds from the FAO or the World Bank.

Phase 1 would take approximately 1-6 months to complete and would see FAO field workers, along with individuals from the Institute of Soil Science and Agrochemistry of Tajikistan, deploy to rural villages to establish locally based educational workshops similar to those the FAO has under the Global Soil Doctors Programme that came to Tajikistan in 2023. These workshops would prioritize female heads of households, often in charge due to the aforementioned male emigration during the growing season, while coordinating closely with community elders from traditional village councils known as mahallas. Workshops would focus on soil biology, crop layouts, and cover crop rotations while also providing the foundation for further education under the national education system. Phase 1 isn't about adding more work; it is about making the work better and more profitable for smallholder farms. Phase 2 would be the first full year and would begin implementation in the highest-risk provinces for desertification, specifically Khatlon and Sughd, both currently at the highest risk of desertification. This would bring workers from the FAO and mahallas to distribute Russian Olive tree seedlings, Persian Walnut cuttings, and basic contour cultivation tools to participating small farmers who went through Phase 1. Why the Russian Olive and Persian Walnut? Both of these trees are designed to withstand extreme weather conditions that continue to plague farmers in Tajikistan, and a special preference will be given to the Russian Olive tree, which in North America is invasive but in Tajikistan is part of the natural ecology and helps return nitrogen to the soil, while also having plants that are naturally adapted to mitigate the effects of the tree and the Persian Walnut to help return a tree variety to where it originated as well as giving a new food source that can become exported and used as a system of trade (World Land Trust, n.d). Phase 3 would become years 2 and 3 of the project, with the cover crops discussed in the Phase 1 courses being distributed under the same system as Phase 2, but with alfalfa and sainfoin seeds to help return nitrogen to the system as well as allowing a grazing crop for the animal husbandry side of Tajik agriculture. During this phase, the seeds would be given during the fallow periods, with plenty of time given to support the

creation of crop rotations, as well as giving fields time to take in the renewed nitrogen from the Russian Olive and Persian Walnut trees while also allowing fields time to rest in between growing cycles to protect long-term soil health. I would also like to reiterate that the Russian Olive tree, while a known invasive species in North America, is actually adapted very well to the environments of Tajikistan without causing issues, and with tools supplied to farmers, can actually be mitigated based on Phase 1 training. Phase 4 would bring years 4 and 5 of the program, with a community seed bank system design with Persian walnut seeds, along with 10% of the seeds from the cover crops going into the banks to help keep the system running long term. Mahallas would take full control of the system in year 5, with FAO and international supporters of the project coming at first in yearly, then biyearly intervals to ensure the project is progressing and that improvements are made when they arise.

Transitioning degraded 0.1-0.2 hectare plots to agroforests requires an initial investment of $180-$250 for all the materials of barestock root, seedlings, and tools. This would be funded from the original $100 million investment that was going to Dehkan farms, and by transitioning the focus, it allows for approximately 500,000 households or 50-100,000 hectares to be restored through this program. For individual farmers, the costs during the growing years when the sustainable systems are being implemented can be offset by growing alfalfa, which ensures feed and a type of cover system while the process is being implemented. This, along with the financial gains after Year 5, would ensure that Tajik farmers are able to make a profit, helping to get more individuals out of the poverty line from crop and walnut sales. Culturally, this project respects Tajikistan's unique community structure by having mahallas as direct leaders of this program, as well as accommodating those who need support the most: the female farmers during the times when the males have emigrated. This project would support the push toward more sustainable agricultural practices in Tajikistan by removing pesticides, restoring soil fertility, and aiding local communities by restoring native plants and the resulting fruits from the Russian Olives and Persian Walnuts, which can provide economic benefits while respecting individual cultures. Phases 1 and 2 would act more as a short-term solution to gain traction in supporting farmers, while Phases 3-4 would be a long-term solution. There is a high level of confidence that this proposal would work due to this proposal using real-world solutions actively being implemented in areas all over the world, with crop stability in Eastern African countries and community-focused approaches in the Middle East and Central America.

Tajikistan is a country full of untapped potential that just needs to be supported by the international community to both embrace its Soviet roots and to chart a new future. Projects like my proposal, focusing on integrated, economically and socially respectful practices while also being sustainable to aid in fixing overall soil health, aid the nation as a whole. By implementing these strategies, Tajikistan can transform its rugged mountain slopes into the foundation for thriving fields. To close, I leave you with the words from two Tajik proverbs: "Ваҳдат пояи иқтисоди қавӣ аст." translated to "Unity is the foundation of a strong economy" and "Олими беамал - занбури беасал" which translates to "A Scientist without action is a bee without honey."

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