



Introduction

The Stalin Plan for the Transformation of Nature, and the East European Experience

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In October 1948 the Communist Party of the USSR unanimously passed the Stalin Plan for the Transformation of Nature. According to the propaganda of the time, nature itself would be subject to the party's dictates.¹ No longer would droughts, hot, dry winds (*sukhovei*), energy shortfalls, or agricultural failures prevent Stalin from achieving superhuman targets in industry and agriculture. The same propaganda claimed that major rivers would be turned into machines, with stepped reservoirs and hydroelectric power stations. Rather than flowing "uselessly" downstream, the water would serve year-round purposes of power generation, irrigation, municipal supply, and industrial processes; they might build a total of 45,000 reservoirs and ponds. Foresters audaciously approved the task of planting 70,000 kilometers of forest shelterbelts—30 to 100 meters deep—to protect farmland from winds and to keep moisture.

Although a massive undertaking for any society, the Stalin Plan for the Transformation of Nature was in fact one program dedicated to improving agricultural performance in the European part of the country, and in particular in the steppe region of the south. It then became connected with a series of related plans to transform and remodel nature in the USSR, some of which, including the 1948 Plan, became known as "hero projects" (*velikie stroiki*) of communism.

In this way the Stalin Plan was more than the 1948 decision with its focus on the European USSR. It was folded into a larger program of economic, scientific, and cultural construction. It was a product of the era of high Stalinism, of bold determination to finish rebuilding

the economy from the devastation of World War II and to advance its military to compete with the United States in the nascent Cold War. Scientists and engineers throughout the nation took advantage of the 1948 proclamation and implicit state support to join their research and development programs to the plan. They gained support to create new institutes. They expanded their foci and intentions to hydroelectricity and land reclamation. Engineers designed locks and canals to improve inland river transport with the goal of linking major seas. In the designs of planners and visionaries the Stalin Plan of 1948 was soon extended to Central Asia and to the expansion and creation of a series of research and construction institutes dedicated to irrigation and canals. The irrigation water would turn vast regions of Central Asian desert, rich in soil nutrients but low in rainfall, into productive farmland and cotton and citrus plantations. There are maps of the period that show the Aral Sea, fed by Stalin-era canals, to serve rice culture. Later Nikita Khrushchev saw the 1948 Plan as part of his Virgin Lands campaign in the mid-1950s.

The Stalin Plan quickly became the focus of myriad articles in magazines, journals, and newspapers, and of public pronouncements about hero construction projects of Communism that extended into Siberia. Literary magazines paid homage to the plan as a vehicle of state and cultural construction. I therefore refer to the “Stalin Plan” for its various scientific, economic, social, and cultural meanings, not only its initial European focus, and for its inspirational and motivational messages among the workers, peasants, Communist Youth League, and Communist Party members who rushed to embrace it. To varying degrees and intensities, with different emphases and possibilities, East European socialist nations, especially in their Stalinist periods of roughly 1948 to 1953, also engaged the Stalin Plan and referred to it as such.

Here I also use the “Stalin Plan” as shorthand for a series of government resolutions for dam, reservoir, canal, forestry, roadway and other construction projects, some of which dated to the 1930s; some required significant investments and institutional expansion even to begin in the years following the promulgation of the plan. The Council of Ministers and the Central Committee of the Communist Party passed the Stalin Plan itself, “On the Plan for Forest Defense Belts, Grass–Arable Crop Rotations, and the Construction of Ponds and Reservoirs for the Guarantee of Highly Stable Harvests in Steppe Regions and Forest-Steppe Regions of the European Part of the USSR,” on 20 October 1948. The dams, canals, irrigation and other projects, many with pre-war roots, were then embedded in this effort.

For example, the government and party passed resolution No. 1339 on 10 August 1937 to build the Kuibyshev hydroelectric complex; the war ended any nascent construction at the site, and the government did not publish a new resolution to build the Kuibyshev power station until 21 August 1950. The Stalin Plan itself was a belated response to droughts in 1946 in Ukraine, Northern Caucasus, Black Earth, Volga, West Siberia, and Kazakh regions that, along with Stalin's murderous investment policies favoring industry over agriculture, led to famine in 1946 (peaking in August 1947) and caused at least one million deaths. To follow through on the forest defense belts thousands of kilometers in length, the authorities created a design institute, Agrolsprojekt, in 1949, that exists in a modern incarnation, to design and carry out forestry projects along the Dniepr, Don, Volga, Ural, and other rivers. Construction on the Volga–Don Canal actually predated the “Stalin Plan” by six months, and itself dated in designs to 1944 and in the popular press to an article in *Tekhnika-Molodezhi* in 1938. All of these projects were gulag slave labor projects, and many of the lead engineers and design institutes were gulag organizations.² While scaled back and eventually abandoned after the death of Stalin in 1953 owing to significant costs, a more accurate understanding of the technical limitations of Soviet “geoengineering” organizations, and likely the absence of the will of Stalin, the plan indicated the great potential for reworking nature in the Soviet Union given the tremendous momentum that ministries and construction firms had acquired and the absence of any public opposition to the environmentally disruptive and fantastical plans.

In East Central Europe after World War II, the newly socialist states followed major aspects of the Stalinist program: secret police and trials; centralization of cultural and educational institutions and their control by party officials; a planned economy; the construction of such “hero” cities as Sztálinváros, Hungary, Nowa Huta, Poland, and Dmitrovgrad, Bulgaria, in line with the single-profile cities arising throughout the USSR; rapid industrialization; and the collectivization of agriculture. Also included in the effort to remold society to one degree or another in socialist Poland, Hungary, and Czechoslovakia was the transformation of nature. But because of firmly established scientific traditions in those countries, their relatively small geographical size compared with the USSR, and the death of Stalin in 1953 before nature transformation programs could be fully established, the impact of nature transformation was smaller and shorter-lived than in the USSR.

On the one hand, wherever it was pursued, the Stalinist plan to transform nature was not very different from many other large-scale nature transformation projects of the twentieth century—the construction of large dams and canals in India and Brazil (for example, the Sardar Sarovar and Tucurui, respectively); the taming of the American West by the Army Corps of Engineers and the Bureau of Reclamation; the harvesting of the rain forests of Brazil and Indonesia; the Panama and Suez canals (the former at a cost of 22,000 lives); geoengineering along the major rivers of China including the Three Gorges Dam (with 1.5 million people ousted from their traditional homes in the flood plain); and many other such expensive, extensive, and environmentally questionable projects that moved ahead with significant social displacement and loss of human life.

Yet Stalinist transformation was geoengineering and agricultural engineering run amok. Leading party officials and scientists set forth aggressive programs to subjugate rivers, streams, steppe, forest, and croplands to party dictates. Planners in central cities, many of them without agricultural knowledge, dictated the establishment of citrus or cotton cultures in regions that could not, for climate, soil and other reasons, support them. Granted, many scientists opposed the hubristic plans, or at least one or another aspect of them, if not for their scientific futility, then for their waste of resources.³ But they opposed the plans in a hostile environment that might lead to official censure or loss of a job or worse, because Stalin and the party had spoken. Many other forestry, hydrology, and other specialists embraced a transformationist ideology steeped in Lamarckian faith in the ability and desirability of scientists to adopt and adapt crops and lands to each other, and for plants and animals to pass along their acquired characteristics to the next generation; in the socialist experience this was called Lysenkoism after the Russian peasant farmer Trofim Lysenko whose Lamarckian policies were officially endorsed by Communist leaders. These specialists benefited in the support to their institutes and research programs. They had no doubt that damming, dredging and straightening waterways was always worth the cost, and that the benefits outweighed potential ecosystem damage, including the flooding of millions of hectares of land.⁴

Whether in the USSR or Eastern Europe, they carried out extensive propaganda campaigns to convince the masses of the utility and glory of their plans, co-opt their assent, and preclude their opposition. They stressed the indisputable fact that such projects were possible only

under socialism—and only under the wise gaze of Stalin. It helped that many East European Communist officials had been trained in Moscow through the Communist International, beginning in the interwar years, and had been fully converted to the belief the state must control nature no less than industry and man. And Stalin's Red Army ensured that each nation would embrace Soviet socialism to one degree or another.

Nature transformation in socialist Eastern Europe was large scale, costly, and environmentally unsound—and abandoned quickly after the death of Stalin. It diverted needed investment funds from other programs, was based on unsound scientific calculations, and would have been inappropriate in East Central Europe in any event given the relatively small size of the nations compared to the USSR, not to mention different scientific traditions and social structures. The programs in each country differed according to their level of economic development, social structure, educational system and its goals, extent of natural resources, degree of urbanization, and so on. The countries had long shared borders, and had only recently abandoned private property. This too served as an obstacle to revolutionary change. Furthermore, they all faced significant pressures and costs to rebuild from World War II—and nature transformation was quite expensive.

The East European socialist nations were not a monolithic communist “bloc,”⁵ and pursued nature transformation to different ends and with more or less enthusiasm. Yet certain common features of East European socialism had an impact on environmental thinking and environmental change in East Central Europe after World War II—especially the Stalinist economic plans for the region. To a greater or lesser degree, the German Democratic Republic, Czechoslovakia, Poland, Bulgaria, Romania, and Hungary embraced one-party systems that were organized through plebiscites, subterfuge, and coercion in which Stalinist Communist parties dominated public and private life. The parties organized show trials of intellectuals and other innocent people with suspect political views, and even of their own party members, with the foregone outcome of guilty verdicts, prison terms, and executions like those in the USSR; the goal was the creation of a class of worker-peasant intellectuals loyal to socialism. The state claimed to organize the economy for the worker through central planning and three-, five-, and seven-year plans. Governments pursued rapid industrialization with a focus on heavy industry, and ignored, at least initially, housing, food, and other sectors that would have benefited

the worker more immediately. The peasant was forced into collectivized agriculture, although many peasants were permitted to own private plots that contributed a small, but important share of agricultural production.

Leaders and many scientists and engineers came to see the environment, like the people in it, as a malleable object, a source of energy, ore, and water to be tamed by the glorious plan in the name of the proletariat. The nations even pursued their own versions of the Stalinist plan to transform nature. Considering the human costs of World War II and the destruction of housing stock, the decision to focus on heavy industry and geoengineering rather than human recovery reveals one of the most disturbing features of the Stalinist model—the emphasis on industrial production rather than human capital. The hubris and impact of the plans to transform nature itself quickly and without adequate study, even if never fully achieved, reveal the danger of environmental management in authoritarian regimes. All of these aspects of the Stalin Plan are clear in scientific, scientific popular, and literary works as it evolved from 1948.

The Nature of the “Environment” under Socialism

The Stalin Plan to Transform Nature had prerevolutionary roots in a series of interbasin water transfer, dams and canals, peasant settlement to the ends of the empire, and other projects. But crucial for its success was a government and Communist Party apparatus anxious to transform the economy, society, and nature itself into a socialist wonderland of plenty. The decision to pursue the plan grew out Stalin’s self-proclaimed great break (*Velikii Perelom*) with past institutions and approaches that arrested Soviet cultural and economic development at the beginning of the 1930s; the seeming victory of the Bolsheviks over the economy and agriculture during the five-year plans; a determination to rebuild the economy after World War II; and the enthusiasm of significant numbers of scientists and engineers to work with the Bolsheviks on heroic projects, with welcome government support for them and their research programs.

Russian dreamers, scientists, and poets had long imagined great projects. The nineteenth century poet Nikolai Nekrasov, who grew up on his father’s estate, Greshnevo, near the Volga, witnessed the hard life of Volga boatmen. But in this poetic excerpt from “On the Volga,” he saw the nation’s future connected with river commerce.

I foresee the beginning
Of the new times and different scenes
In the fortuitous life
Of my favorite river:
Liberated from shackles,
The tireless nation
Will mature and densely settle
The coastal deserts;
Science will deepen the waters;
Through their smooth plain
Giant ships will swim
Like an uncountable crowd,
And the exhilarating work will be eternal
Above the endless river . . .

From their first days in power, the Bolsheviks set out to create socialist industry, establish workers' control of major enterprises, give land to the peasants, and nationalize all forests, waters, and subsoil minerals with the goal of rational use.⁶ Many of Lenin's early proclamations concerned forestry, agriculture, and irrigation. Early Bolshevik leaders believed that under socialism they could indeed transform desert into productive farmland, end poor forestry practices, and even eliminate forest fires.⁷ However, the Russian Revolution and resulting civil war and anarchy put "nature" at great risk. This risk abated during the New Economic Policy of the mid-1920s. Several engineering projects commenced at this time in the Caucasus and Steppe regions near Saratov, Samara, and Astrakhan. Stalin himself wrote about several of them and stressed the importance of using irrigation to increase grain production in the Trans-Volga region.⁸

At the same time nascent environmentalism grew among professionals to establish inviolable nature protection areas and encourage conservation of resources. Ecologists and other scientists, amateur naturalists, and a variety of citizens participated in an extensive nature movement in the USSR. The movement had prerevolutionary roots. Some of its organizations became the largest voluntary societies in the USSR and included the Moscow Society for the Admirers of Nature and the All-Union Society for the Preservation of Nature. These organizations actively sought to temper breakneck economic development and successfully lobbied the government to establish a series of nature preserves (called *zapovedniki*). From the 1930s specialists, however, the

organizations and individual scientists were co-opted and coerced to figure out ways to use nature for the economy, and they struggled to protect the *zapovedniki* and promote conservation measures against state efforts to encroach on the nature preserves and subjugate greater and greater tracts of forest and field to development programs.⁹ Given the imperatives of the Stalinist economic model and the lack of autonomy of specialists, they had limited influence on the scale or content of nature transformation plans. As we shall see, in Eastern Europe these early environmentalists managed to maintain greater autonomy and worked quietly to limit the impact of transformationist plans.

But during Stalin's great break, party officials, economic planners, and engineers joined in the effort to master the empire's extensive natural resources toward the end of economic self-sufficiency and military strength. At their order, armies of workers began the process of constructing giant dams and reservoirs on major European rivers—the Don, Dniepr, and Volga. They planned extensive irrigation systems across Central Asia. They built canals and waterworks. The workers erected massive chemical combines, metal smelters, and oil refineries in both European and Siberian parts of the country, paying little attention to the pollution they produced. They put up entire cities to house the laborers whom they exhorted to meet plans and targets, irrespective of the environmental costs and the risks to the workers' own health and safety. Scientists, party officials, and writers produced self-conscious, self-serving literature praising these hero projects, without any sense of the ideological ironies, human sufferings, or environmental degradation that ultimately accompanied this "heroism." Beginning with the White Sea–Baltic Canal, they employed gulag slave laborers in murderous large-scale projects. Indeed, many of the hero projects were in fact built by gulag organizations. The major Soviet hydro-engineering design and construction firm, Zhuk Hidroproekt, actually was born in the blood and lives of seventy thousand prisoners at the White Sea–Baltic Canal Construction. The Belbaltlag slave camp director, Sergei Zhuk, used prisoners as fodder and used them to set up other canal and dam construction organizations that moved down the Volga and built Stalin's water works. (Hidroproekt exists in the twenty-first century under Vladimir Putin as RusGidro.)

Immediately after the White Sea–Baltic Canal, many Belbaltlag prisoners were sent to build the Moscow–Volga Canal. In 1931 "Comrade Stalin proposed to build a canal and turn the Volga to the walls of the Kremlin." They built the canal in four years, with 240 major structures

including locks, pumping stations, dams, and tunnels. They excavated 200 million cubic meters of rock and soil, cut the shipping distance from Moscow to Gorky by 110 kilometers, and provided water for Moscow industry and residents through the Moscow River.¹⁰ In July 1937 the first ships traversed the canal, cutting the distance between Leningrad and Moscow by 1,110 km and between Moscow and Gorky by 110 km. They built the Ivan'kovskii (1937), Uglichskii (1939), and Shcherbakovskii (1941) waterworks along the Volga River. They created the Moscow Sea at 327 square kilometers; the Rybinskoe Reservoir at 4,100 square kilometers; and other massive seas.¹¹ (As ships entered the canal from the Volga, they passed by statues of Lenin and Stalin on either side; Stalin's was removed in 1961 but the pedestal remains, and Dubna city residents now use it to train for rock climbing.) The camps had their own environmental and of course human costs. In this way, the pattern for the Stalin Plan of 1948 was established: large-scale projects carried out by armies of laborers, many of them slave laborers.

Not only canals and dams, but bridges, forestry, smelters, mines and factories—and their construction organizations—spread inexorably from one finished project to another in response to the whims of Stalin's planners, who drew lines across maps and circled various locales that indicated their suitability for rapid development. The planners did so in the confidence that the small landowners endemic to the capitalist system had been eliminated through class war and so could not interfere, while nature herself could no longer resist the planner's pencil or the builder's bulldozer under socialism. While in some cases the socialist regimes of Eastern Europe the authorities resorted to slave labor in their industrial, agricultural, and forestry projects, those projects were never on the scale of Soviet ones, nor, apparently, did they create entire forced labor camps dedicated to the geoengineering and nature transformation, although they used prisoners. Yet they embraced the notion that, under socialism, they could draw lines on maps with planners' impunity.

The Stalin Plan for the Transformation of Nature combined pre-revolutionary ideas with glorifications of the socialist economy in the 1930s. In *Men and Mountains* (1935), called by Maxim Gorky a "prose poem," M. Ilin (pseudonym) described many projects that dated to any early era and the determination of the Soviets to remake nature—its forests, rivers, deserts—and turn nature into an instrument of the socialist economy. Planning and science would turn the steppe into

farmland; new dams and canals would open cotton plantations; the Amu Darya and Syr Darya rivers would be diverted to Central Asia for fruit growing and would enable ships to sail from the Caspian Sea, while hydroelectric power stations would furnish “light for cities and electric power for machines.” Already in May 1932 Stalin and Molotov signed “a decree against the elements” for “Ending Droughts in the Volga Territory” with forest shelterbelts so that water would gush forth and flow over the fields.¹² Engineers would make the Volga deeper and faster to become the main traffic artery of the country and would link, also by railway, the center of the country to the Arctic through the Kama and Pechora rivers, and to the Baltic and White Sea.¹³ Rivers would be bridled, weather controlled, there would be no floods, Arctic ice would be melted for agriculture, and so on.

Since, in the 1930s, planners focused investments on rapid industrialization and the collectivization of agriculture, large-scale nature transformation would wait until after World War II. Yet Soviet authors celebrated a number of signal achievements that presaged the hero projects of the late 1940s. In agriculture, for example, collectivization destroyed what they believed were ingrained and unscientific peasant farming techniques and replaced them with a kind of socialist agribusiness. Modern machinery required collectivization, because new tractors, combines, and other equipment could run to the horizon and back during plowing, sowing, and harvesting. There is, in fact, some evidence that modern agribusiness inspired some American farmers who visited the USSR in the 1930s and saw what machinery could do on massive plots.¹⁴ In any event, in the USSR, the experience with big earth-moving and harvesting machines in agriculture encouraged thinking about how to alter nature itself, and led to the development of massive bulldozers, section dredges, and other equipment.

During the first five-year plans, several distant transformation projects from the Arctic to Central Asia, and from the plains of Europe to Siberia and the Far East, accompanied urbanization—so-called socialist reconstruction. Scores of new industrial towns and cities appeared, notably Magnitogorsk in the Ural region, Norilsk, Kirovsk, Molotovsk, and others. These would serve as models for the East European hero cities of metallurgy, concrete, and power production. Yet Stalin did not overlook nature itself. At the Seventeenth Party Congress in 1934 Stalin called for increases in irrigation systems in the Trans-Volga region and afforestation through the planting of forest shelterbelts to fight drought. He said:

As you know, this work is already taking place, although it cannot be said that it is being carried on with sufficient intensity. As regards the irrigation of the Trans-Volga area—the most important thing in combating drought—we must not allow this matter to be indefinitely postponed. It is true that this work has been held up somewhat by certain external circumstances which cause considerable forces and funds to be diverted to other purposes. But now there is no longer any reason why it should be further postponed. We cannot do without a large and absolutely stable grain base on the Volga, one that will be independent of the vagaries of the weather and will provide annually about 200,000,000 poods of marketable grain. This is absolutely necessary, in view of the growth of the towns on the Volga, on the one hand, and of the possibility of all sorts of complications in the sphere of international relations, on the other. The task is to set to work seriously to organize the irrigation of the Trans-Volga area.¹⁵

The pre-war years were a prelude to the transformation of nature. From 1927 to 1941 laborers planted more than 468,000 hectares of shelterbelts at collective farms – forty-three times more than was planted in the entire Russian Empire from 1817 to 1917. By the third five-year plan the amount of irrigated land had increased by 75 percent since the revolution.¹⁶ In all cases, it is difficult to verify Soviet data, which was frequently exaggerated for the consumption of domestic and foreign audiences. But there is no doubt that the Soviet planners truly increased the production of industrial goods, electricity, irrigation, and so on many fold.

Electricity would power this transformation; Soviet molecule counters had enumerated 108,000 rivers in the USSR with 15 percent of the world's hydroelectric potential, many of them in Siberia. They referred to rivers as "white oil." In terms of the USSR, 80 percent of the nation's hydroelectric potential was on the Siberian Ob, Lena, Enisei, Amur and Angara rivers.¹⁷ Between 1928 and 1953, hydroelectricity capacity grew forty-seven fold. Soviet engineers moved forward unabashedly in a variety of climatic and geological conditions along rivers from the Arctic Circle to the steppe, to arid Central Asia, and to Siberia, along the Dniepr, Svir, Kura, Syr Darya, Dnestr, Narva, Rioni, Kovda, Kama, Don, Niva, and Razda rivers.¹⁸ No river would escape the search for ways to power and water nature transformation.

Planners focused on large-scale integrated geophysical technologies to achieve the goal of the transformation of nature. The so-called hero

projects—dams, weirs, hydroelectric power stations, irrigation and transport canals, sluices, forest defense belts, and the like—were the epitome of modern technology; yet, paradoxically, they were built with poorly equipped armies of men who had fewer steam shovels and bulldozers, fewer trucks, fewer horses(!), and fewer wheelbarrows than they needed. Capital was expensive, while labor inputs were easier to requisition, even if it meant using gulag slave labor.

Stalin Begins to Rebuild in Earnest

In the midst of a difficult recovery from World War II, with millions of people still living amongst the rubble or in dug-out earthen huts called *zemlianki*, and with factories, power stations, and infrastructure in ruins, the tireless Stalin set the nation on a course to transform nature, with geoengineering projects from the White Sea to the Ural Mountains and to Central Asia, with hydroelectric power stations rising on the Volga and other major rivers, with Lysenkoist agriculture spreading into formerly barren or underperforming fields, and with harvests of grain, barley, rye, cotton, and fruits increasing up to fivefold. In six to seven years, irrigation would enable the production of sufficient grain, sugar beets, vegetables, fruits, and livestock to feed a hundred million people.¹⁹ Even more fantastic, the Soviets promised that within twenty-five to thirty years they would turn the sand of Turkmenistan and Uzbekistan into forested lands capable of producing thousands of cubic meters of wood annually, and that the Central Asian republics, each now with its own Academy of Sciences staffed with eager engineers, would engage water transfer projects to create gardens of cotton and fruits. Rivers would be tamed and rapids removed so that barge and steam ship travel would grow significantly. The White, Baltic, Azov, Black and Caspian seas would be tied together into one transport nexus. The major focus was stepped reservoirs and power stations on the Volga, including the largest in the world, the Kuibyshevskaya, the Stalingrad, and others that would permit the irrigation of millions of hectares of the Sarpinskaia and Nogaiskaia Steppe.²⁰ A propagandist, Kasimovskii, wrote, “In the country of Soviets this utopia became a reality.”²¹

In order to reach the level of communist plenty, not only industry, but agriculture would have to be revolutionized in the postwar years, with ever more ambitious hero projects and with increased sowing and harvests, new crops, and better animal husbandry. To achieve

these agricultural targets they needed forest defense belts, irrigation systems and hydroelectricity to transform the landscape. One-fifth of land in the European part of the country was steppe and forest steppe regions of the European USSR that suffered from droughts and dust storms. Soviet scholars were determined to overcome the constant droughts that revealed the ineptitude of the Tsarist regime in handling crises—for example, the famine of 1891. They and political leaders were also aware that civil war (1918–1920) and postwar crises (1945–46) had resulted in a total of five to six million deaths by starvation and disease.

Stalin's plan primarily required vast stretches of land to be afforested in the south of the country in order to prevent the dry winds, coming from the steppe of Kazakhstan and Central Asian deserts, from penetrating the fields and causing damage.²² Planners also intended to plant up to 80,000 miles of forest defense belts, built from trees planted in up to three bands 30 to 50 meters in width; they succeeded at great cost in planting only 5,000 kilometers.²³ With Bolshevism, adherents of ambitious afforestation plans came to power. World War II had halted afforestation, but in 1947 the Ministry of Forestry Management advanced a program for 1.5 million hectares of forest, followed in 1948 with another 5.7 million hectares—in part in response to the famine and grain failure of 1946. As part of Stalin's plan, the “world's largest waterworks along the Volga, Dniepr, Don, and Amu Darya, the canals and reservoirs” would revolutionize travel and tie the entire country together, region to region, countryside to city.²⁴

Soviet authors saw the hero projects as crucial for an agricultural revolution including crops, trees, and animal husbandry, and equally to create modern, socialist relations between burgeoning cities and the countryside. The massive waterworks on the Volga, Dniepr, Don, and Amu Darya rivers, the construction of gigantic canals, the creation of irrigation systems, and the mechanization of labor would move along seamlessly. The water works would magically create *smychka*, the legendary and anticipated bond between urban and rural life, while the proletariat would lead the peasant into the twenty-first century. Yet, even though Stalin had used collectivization to break the peasantry and to extract capital for industry, he ultimately realized that the countryside was starved of investment. He turned to hero projects as the most efficient way to achieve all ends, including subjecting nature to man's control and serving as work sites where the proletariat could be indoctrinated about the glories of socialism. Stalinist hero projects were a

powerful lever to end contradictions between city and countryside once and for all.²⁵

As a prelude to the Stalin Plan, in July 1947, after decades of underinvestment in the countryside that had left collective farms impoverished in terms of modern equipment and power, government officials determined to provide farms with electricity. The countryside really was dark: many collective farms had no electricity whatsoever, not even small generators, and those with generators had difficulties getting parts and gasoline. Lucky farms had a few light bulbs, but labor continued to be nineteenth century: on the hands, shoulders and backs of peasants, with horses, and perhaps the occasional rusty tractor. Now the government passed a decision to irrigate 575,000 hectares in collective farms of the central black-earth regions with pumping terminals powered by 590 new small hydroelectric power stations, generators, and wind power, with the work to be completed within six years. The next year the government approved the construction of shelter belts in collective farms that would cover 1,350 hectares by 1951.²⁶ But have no doubts: no significant or successful rural electrification program resulted under Soviet power, in spite of the utopian belief that “Communism equals Soviet power plus electrification of the entire country” (a 1920s slogan).

The fascination with electricity produced fantastical forecasts nonetheless. What did Comrade Stalin have in mind that East European Communists wished to emulate? Perhaps drawing on Lenin’s inspiration, he saw electric tractors, combines, and other machines to mechanize all agriculture and revolutionize production. In 1949, at Stalin’s insistence, apparently only as a limited experiment, several Machine Tractor Stations established electrical tractor stations with thirty tractors that operated nearly 40 percent cheaper than gas-powered tractors. The feeding and watering of livestock, shearing of sheep, and other activities would also be electrified. The capitalist farmer no doubt would be shocked to learn that the Soviet collective farmer had never heard of electric sheep shears.²⁷

Stalin’s plan used military rhetoric. It was “a battle with drought and salinization of soil” to overcome the technological lag of Tsarist Russia and increasingly frequent droughts. Between 1917 and 1951, irrigation systems spread south to Uzbekistan, Kazakhstan, Tadzhikistan, Azerbaijan, Armenia, the Trans-Volga, and Southern Siberia. One of the pre-war hero projects that opened in 1939 was the Stalin Great Fergana Canal; at 270 kilometers in length, it was built by 160,000 Uzbek and Tajik collective farm laborers—and no doubt slave laborers as was

the case in other hero projects. At the beginning of the 1930s, Central Asian camps of the secret police were established to build water works and finish some fifty-two projects, according to one source, including the Fergana Canal. But “amazingly” it was built in only forty-five days, with workers relying on shovels and picks, and toiling directly under the hot sun.²⁸ The canal was crucial to Central Asian agriculture with its multitudinous sunny days but arid soul. Harvests of cotton, sugar beets, oats, rice, and corn all grew substantially. Roughly 25 percent of the Amu Darya river was intended for the canal so that the Aral Sea would lower its level—catastrophically as they must have known—but they were thrilled that they had reclaimed land for agriculture, even if the saltiness of the water had a negative impact on productivity.²⁹ The goal was great agricultural nature transformation in Karakalpakia and in the Karakum, and inland water shipping from the Volga to the Amu Darya.

Shelter belts, with their own prerevolutionary roots, were another important feature of the plan.³⁰ They had a long history in world forestry and were tried experimentally in the nineteenth century. The US government supported the planting of shelterbelts in the 1930s in the “Plains States” to try to ameliorate the devastating impact of the Dust Bowl and to put laborers back to work through the Works Progress Administration.³¹ In the USSR in the 1930s, specialists were gearing up for their planting as they studied the influence of shelter belts on microclimate and, in turn, on harvest of various cultures. They considered the geometry of plots and planting, of height and density. They worried about planting along roadways where winds might create significant drifts, and so called for planting denser, shorter bushes in addition to trees. They propagandized their efforts in such journals as *Na Lesokul'turnom Fronte!* They founded such research centers as the Institute of Agroforest Melioration and Forestry.³²

The transformation effort yielded, in addition, Cold War rhetoric. The heroic old Bolshevik who directed the State Plan for Electrification of Russia (GOELRO, set in motion in 1918), Gleb Krzhizhanovskii, a friend of Lenin and one-time head of the State Planning Administration, Gosplan, kowtowed before the “geniuses of the proletarian revolution—Lenin and Stalin” as a 70-year-old. He celebrated GOELRO for upsetting capitalist doubters that the USSR had surpassed Europe and would soon surpass the United States in electrical energy production. He reminded the postwar Soviet public that while such projects as Dnieprstroï had been met skeptically by the bourgeois press,

“the enemies of our motherland were convinced finally by the reality of our plans.” The bourgeois press realized that the “Leninist-Stalinist teachings about electrification” were the “unshakable foundation of our energetics.” The planned system had given the nation the Svirskaiia and Rybinskaiia stations, the Chirchinskii cascade in Uzbekistan, projects on the Kama River, reworking of rivers in the Caucasus, and the Main Turkmen Canal. The latter would solve the problem of 300 million hectares of desert in the USSR, of which the Kara Kum alone covers 250 million hectares—27 percent of the area of Soviet Central Asia. Electrification and hero projects would subjugate the Amu Darya River to the desert. Krzhizhanovskii pointed out that while many big projects unfolded under capitalism, they did not benefit the worker—for example, the Suez Canal built by poorly paid laborers, the Panama Canal with large numbers of laborer lives lost, and other capitalist projects.³³ Krzhizhanovskii did not refer to the hundreds of thousands of slave laborers who perished building Stalin’s waterworks.

The Bolsheviks considered electrification a panacea and referred to it as a “child of the revolution.” They debated whether to rely on peat or coal, and whether to build centralized generating stations or decentralized. But hydroelectricity captured their imagination, as it would under Stalin when the USSR and the United States engaged in kind of a “hydropower race” to erect the biggest, most powerful stations in the world on the Volga and Columbia rivers respectively. The first projects commenced near Leningrad on the Neva, Volkhov, and Svir rivers, and at Imatra near the Finnish border, in the 1920s. The reconstruction of the Volga began in the 1930s in its upper reaches, with dams at Ivan’kovskaiia, Uglich, and Rybinsk. After the war as part of the Stalinist plan, these projects moved ahead with the construction of such massive hydroelectric power stations as the Kiubyshevskaiia, at its completion the largest in the world—and perhaps the largest gulag project ever with as many as two hundred thousand prisoners, the Stalingradskaiia, and others. Soviet engineers saw power stations as “factories of electricity” that work the ore of water—its mechanical energy. This all gave way to the “Big Volga” project to transform the river from its source to the Caspian Sea.³⁴ For this project—as for the ones before and after it—since it was designated an all-union project of national significance, resources and laborers were requisitioned from around the country. Construction crews moved up and down the Volga River, trucks came from Moscow, tractors and bulldozers from Kharkov, dump trucks from Minsk, specialty steels from Petrozavodsk, cranes and steam shovels from the

Urals, turbines from Leningrad, and so on.³⁵ Centralized requisitioning did not overcome bottlenecks and shortages, but also created them in other sectors and regions of the country that had to devote efforts to Stalin's determination to change rivers.

A significant aspect of the Stalin Plan to Transform Nature was its focus on creating an agricultural wonderland of expansive farms, plentiful harvests, and new crops grown on irrigated and protected steppe and desert according to Lysenkoist and Michurinist ideas. What precisely did they mean by "Michurinist" and "Lysenkoist"? Ivan Michurin, a plant selection specialist, created a massive collection of plants and pursued genetics research, cytology, and hybridization. He created all sorts of fruit plants. Because of his practical contributions to agriculture, and because of his somewhat Lamarckian view that the selectioner should work to promote natural selection, the Lysenkoists embraced him as a hero of proletarian biology versus "fruitless" genetics.³⁶ They often quoted his saying: "We cannot wait for favors from Nature. Our task is to take them from her."

As the authors of these chapters write, Trofim D. Lysenko was a quack scientist who falsified data, misled funding agencies, and used extra-scientific channels to destroy his opponents, real and imagined. His class origin as a peasant helped his career, as did his promise to achieve significant results in the short term to help suffering Soviet agriculture. Lysenko also based some of his work on real science, for example, vernalization, the treatment of plants with cold and moisture to get them to flower in the spring. He was attracted to the work of the Michurin, who used a kind of Lamarckism to change species among plants through hybridization and grafting; but these were non-genetic, Lamarckian techniques that claimed the inheritance of acquired characteristics. No matter the Lysenkoists' claims, they could not deliver plants or animals whose new characteristics were heritable. But they promised the transformation of nature.

Lysenko rose rapidly to dominate agrobiolgy through extra-scientific channels. It helped Lysenko that Isaak Prezent, a Stalinist ideologue, propagandized the simple peasant Lysenko as a genius with radical new agricultural techniques. Soviet leaders, including ultimately Stalin, embraced Lysenko as a hero—a new Soviet hero. All of this enabled Lysenko to dominate the Soviet biology and agriculture establishments from the 1940s, especially after a 1948 conference that declared Lysenkoism as the only form of Soviet biology, while attacking genetics as a bourgeois science.³⁷

In 1948 at the Lenin All-Union Academy of the Agricultural Sciences, Lysenko and his followers took control of genetics—in fact, rejected genetics—and with the approval of Stalin carried out a purge of geneticists from the academy, and genetics from textbooks and libraries. Lysenkoism and the idea that nature can be transformed and improved were mutually reinforcing. Lysenko's ideas were devastating to agriculture and wherever they were applied. For example, in the pursuit of shelter belts, Lysenko insisted that trees be planted in clumps or nests where their inherent “collectivism” would lead them to thrive, as opposed to being planted individually at some distance from others, like some kind of exploited capitalist laborer. In this way, the grandiose Stalin Plan for the Transformation of Nature was Lamarckian and Lysenkoist.

Taking a different view, Stephen Brain argues that the plan was an attempt “to reverse” human-induced climate change with its goals to create six million hectares of new forest to cool the air, moisten the soil and raise humidity. Scientists and forest specialists, whom Brain calls “technocrats,” had Stalin's ear and convinced him of the need to fight drought through the measured application of knowledge. But the death of Stalin ended the ascendance of their “technocratic ecology.” Brain notes that other utopian visionaries believed that communism would end all natural limitations. They believed that forests could be made to conform to human will, while the technocrats relied on science to take into account local variation and natural limits in their plans. It helped that Cold War rivalries and pressures egged visionaries onward, for they believed that only the progressive socialist USSR could do with nature what was needed for the people, while in capitalism droughts and dust bowls would remain. In this view, the Stalin Plan reflected larger trends toward conservatism in Soviet society in culture, literature, family policy, and education. Hence the plan meant a focus more on stability than on radical restructuring.³⁸

According to Brain, Lysenko kept Promethianism alive from his positions in the Agriculture Academy and in his visions of transforming crops and nature. He jumped on the afforestation bandwagon; he did not jump-start it. And he applied his crazy Lamarckian-socialist ideas to it to suggest that trees were collectivists. He called for planting of trees in nests—especially based on his work on the dandelion-rubber plant *Kok-saghyz*. Collective nest planting was a complete failure. In fact, for a variety of reasons the eight great shelterbelts were only 46 percent completed, less than half of the area planned for sowing was

afforested, and more than half of the seedlings planted between 1949 and 1953 died.³⁹

Shockingly, transformationist plans did not adequately take into consideration “science” when it interfered with grandiose visions. How could one rework nature and then ignore soil, topography, and climate? The effort to rebuild and recast agriculture in the USSR and in postwar Eastern Europe required extensive agronomical knowledge, from soil to vegetation to techniques. Much of this knowledge had not only pre-revolutionary roots but also originated in the Russian empire. In the nineteenth century, Vasily Dokuchaev, soon to be revered by Soviet patriots, demonstrated that soil types differed because of geological, climatic, vegetative, and topographic factors, and developed important soil classifications that he introduced in *Russian Chernozem* (1883).⁴⁰ In other words, it was important to consider climate, vegetation, country, relief, and age in a modern soil science. But many Lysenkoists thought it more important to engage agriculture practically, and thought that too much research, including that of Dokuchaev, was too theoretical or lacked the imprimatur of “practice,” especially socialist practice, which would prove them right in the end.

Hence from modest beginnings at Volkhovsk and Svirsk, and then Dnieprostroi, the Soviets turned to gulag-based projects on the White Sea–Baltic Canal, the Moscow Canal, and other Stalinist waterworks near the capital, to the Great Fergana Canal. The immense costs and devastation of the Nazi invasion interrupted further projects and destroyed many that had been built. After the war, the party focused on rebuilding industry. By 1947, recognizing that agriculture lagged significantly (and had never recovered from Stalin’s own war against the countryside in collectivization), party leaders decided that only a large-scale nationwide campaign to rebuild nature itself would increase agricultural production, build a unified transportation network, conquer drought, and grow fruits, cotton, and other crops according to Michurinist–Lysenkoist fashion in previously arid regions. What was the impact of these plans and ideas on the East European socialist nations of Czechoslovakia, Hungary and Poland?

Red Army Nature Transformation

In 1951 in a replica-translation of a Soviet publication, Klement Gottwald, a Stalinist and early leader of Socialist Czechoslovakia, who pursued collectivization and industrialization with delight and vigor, and carried out murderous purges of Czech communist officials,

published *For the Happiness of the People: The Transformation of Nature in the Stalinist Era* that carried a frontispiece of a painting that depicted Stalin drawing channels and rivers across a map of the Soviet Union to indicate the way that nature should be. Behind him stood Politburo members and Army marshals who clearly approve of his battle map for a war on nature.

In East Central Europe the experiences with “nature transformation” shared many of the features of this dramatic painting. In Czechoslovakia, Poland, and Hungary, Communist regimes pursued rapid industrialization, including the construction of socialist cities; they aggressively sought to tame waterways for municipal and industrial water supply, and for transport and irrigation purposes; to a greater or lesser degree they embraced a revolution in agriculture, with new crops and approaches through collectivization and through flirtation with Lysenkoism; and they explored afforestation programs. They proselytized these programs with scientists and among the public in a variety of forums and through a variety of media.

The governments moved rapidly to adopt Stalinist transformation projects as part of their overall programs. In Czechoslovakia the Communists took over the government in a coup in 1948; two months later, after the nationalization of land, industry, minerals, and limiting holdings to fifty hectares, they undertook violent collectivization of agriculture along with its mechanization. The Academy of Agricultural Sciences provided socialist agronomy; it was subjugated to the Ministry of Agriculture and the Agricultural Department of the Central Committee of the Communist Party. Ultimately, because of the tradition of intensive agriculture and the relatively small size of the country, the Stalin Plan for the Transformation of Nature had relatively little impact in Czechoslovakia. But the socialists were determined to achieve fantastic results against all odds. Toward those ends, the authorities promoted the spread of Michurinist agrobiolgy, applied Stakhanovite methods⁴¹ in agriculture, and established massive construction trusts to build reservoirs in pursuit of the Soviet vision of turning infertile land into fertile fields, orchards, and gardens, with forests to regulate wind erosion.

A lexicon of transformation unfolded in the media. Officials discussed a concrete plan to follow the Stalin nature plan early in 1949 with a ten-year horizon that included some aspects of all of its features, from tree-planting shelterbelts to Michurinist agriculture. In the Czechoslovak Academy of Agricultural Sciences, a cult of Lysenko

developed and specialists undertook struggle against “Cosmopolitanism and Objectivism in Science.” Czech specialists joined pilgrimages to see the god, Lysenko, in Moscow, and to learn how to turn theory into practice. Under socialist power the Czechoslovak Agricultural Academy, which dated to the 1920s, followed the Soviet economic development model to introduce Michurinism. The academy funded applied research at the expense of basic science when it was subordinated to the Ministry of Agriculture. Similarly, through coercion and co-optation, engineers pursued proletarianization of the engineering sciences.

In practice, what happened? Shelterbelts were already standard measures for protecting the landscape in Czechoslovakia—as they had become throughout the world. During high Stalinism the forestry specialists and party officials intensified the program in the hopes of changing the hydrology of the entire country. From Czechoslovak plans to popular brochures about them, officials and specialists emphasized the importance of forests for transforming nature. Forests were no longer a resource, nor the interest of conservationists alone, but a means through which to control nature and to follow the Soviet designs, although not in Soviet grandeur.

Experimentation with and introduction of crops had a major place in Czechoslovakian transformation plans. Just as the Siberian plains were to be planted with a special pear tree bred by Michurin, Czechoslovakia was to be planted with rice, which, according to Soviet experts, would work well. Specialists hoped to have an indigenous variety within ten years that required less water and a shorter growing season, and of course replete with higher yields. The effort to spread “Michurinist methods” in Czechoslovakia involved attempts to attract local groups of teachers and agronomists who worked in local clubs and groups that turned out to be like an agricultural extension service. “People’s research” also made its way into schools. In 1954, seventy thousand primary and secondary school students were involved in organized clubs. New Stakhanov-like campaigns helped to raise sugar beet production too. Of course, focusing tremendous labor resources in any sector should increase production.

As in the USSR, the nation required an agricultural revolution and the tying of the peasant to the collective farm to feed burgeoning cities and industry. Cities were rebuilt, renamed, and established next to deposits of the ore they were intended to work; for example in Vitkovice in the Ostrava region, the “steel heart of the republic,” with its Gottwald New Steelworks and Gottwald Steel Rolling Mill—like Nowa Huta near

Krakow, Poland. Grandiose plans to develop the region required, in 1950, almost one-fifth of all state investments (17.5 percent). But party officials justified the expenses because the mills were crucial to gather large numbers of agricultural workers in one place to transform them, too—in this case into an industrial proletariat. During the first five-year plan alone, Czechoslovakia invested more than 558 billion crowns in large-scale construction projects: first new steel mills, then reservoirs and hydroelectric power plants. Construction required infrastructure of roadways, railways, power lines, the excavation of 2.5 million cubic meters of earth, and the pouring of 700,000 m³ of concrete. Stalinist transformation always meant more excavation—and more concrete.

Like Soviet “all-union” and Communist Youth League construction sites, Czechoslovak officials used a publicity campaign to attract young men and woman through slogans that were military metaphors: To the front! To the battle! These signified a war on nature. However, the campaign approach did not guarantee rational use of resources. Instead, construction sites were pools of mud and disorder; the lack of experienced designers, construction engineers, and workers slowed efforts, as did show trials, like those of engineers in the USSR, to affix blame for failure to reach targets.

Not having learned from Soviet practices that submerged hundreds of thousands of hectares of fertile land in flood plains—or having determined these were acceptable costs—officials planned a systems of reservoirs and dams on the Orava River in Slovakia that would be the largest in all of Central Europe, in part to achieve a fivefold increase in the production of electricity. They planned reservoirs on the Vltava, the longest Czech river, on the Váh River in Slovakia, and on the Danube where the Gabčíkovo-Nagymaros Reservoir would rival in size the Dnieperstroi Dam, one of the first Stalinist hero projects of the 1930s. Czechoslovakia pursued this project only in the 1980s, and it was killed by legal and environmental concerns and an international legal dispute between the Czech Republic and Hungary.⁴²

However, Czech projects moved ahead more carefully than Soviet ones, applying more the effort to stretch water resources among municipal, industrial, and agricultural demands, not “controlling nature.” Even in this environment, an impoundment boom resulted: before the war there were thirty-seven reservoirs and a total volume of 173 million m³, but between 1945 and 1962 twenty-three reservoirs were built, with a total volume of 1,147.9 million m³. The Orava Reservoir was the first great hero project, with a surface area of 35 km² and a volume of 350

million m³. As with many of the projects set forth under socialism in the USSR and in Eastern Europe, the Orava Reservoir had pre-socialist roots. Fittingly for a hero project, the reservoir was touted in the media, attracted thousands of workers, and served as the basis for a socialist realist production novel, Dušan Kodaj's *Oravská priehrada* (1953). Such socialist realist novels had been a standard in the USSR since the 1930s. A second hero project was a series of dams on the Váh River, the "Váh Cascade" for hydroelectricity, and it had a similar sociocultural response. Other geoengineering focused on the Vltava Cascade in Bohemia (with 3 major dams, the first of which was the Slapy hydroelectric plant with an output of 144 MW, the Lipno, and the Orlik).

The Soviet influence in nature transformation persisted after Stalin's death—in corn under Nikita Khrushchev; Khrushchev grew convinced that a crash campaign to plant corn would solve a growing shortage of fodder, yet pursued it inconsistently and without careful planning, with costly agricultural and environmental failure the result.⁴³ Still, in his "Secret Speech" at the Twentieth Congress of the Communist Party of the Soviet Union in Moscow in January 1956, which condemned Stalin's "cult of personality" and murderous acts, Khrushchev opened Stalinism to criticism, including in East Central Europe, leading to liberalization of regimes generally, and to rejection of the Stalinist Plan for the Transformation of Nature, or at least large parts of it, including in Czechoslovakia.

From Sztálinváros to Hortobágy

In Hungary, Communists repeated the pattern. Between 1947 and 1949 they abolished the multiparty system, nationalized private property, and centralized control over the economy, education, and culture. Power was assumed by a small group of the Hungarian Workers' Party led by Mátyás Rákosi, who had his own cult of personality. By August, Hungary was a Soviet-style "republic" with arrests, show trials, exiles, and executions of enemies, including within the party. Nationalization of the economy proceeded rapidly: first coal mines and major banks were taken over, then factories employing more than one hundred individuals, next those with more than ten, and so on. Class war against the bourgeoisie proceeded with workers, peasants, and only then intellectuals to reap the benefits of society; new intellectuals from working-class backgrounds and faithful to the system were advanced into positions of power, mirroring the process in the USSR in the late 1920s and 1930s called *vydvizhenie*. Stalinist cities contributed to this process: peasants

left villages in droves to gargantuan industrial development projects that relied heavily on Soviet resources—Sztálinváros, Kazincbarcika, and Komló.⁴⁴

Cultural revolution also proceeded in Hungary. It included an assault on the Academy of Sciences to bring it in concert with the political and ideological directives of the party. Reductions in staff by retirements, illnesses, and stays abroad were followed by purges and demotions, while communists were advanced to full membership. This meant that scientific R & D was now controlled by the Communist Party. The academy was prepared to consider, and approve, nature transformation policies that affected water-supply management, soil cultivation and forestry, and introduced new crops completely foreign to Hungary's climate. Cultural revolution involved the establishment of new secular schools with 8-grade compulsory education. The authorities succeeded in eliminating illiteracy rapidly, but schools were overcrowded, programs put emphasis on vocational skills, and re-attestation of professors based on their political beliefs created havoc. Churches and the Church were attacked, including show trials. Socialist realism replaced all other forms in the arts, literature and music, and imitating the Soviets, the system introduced *chastushki* or made-up agitation verses. Granted, there were such achievements as social security, housing, and health insurance, if very low wages, but housing would remain a sore spot as the population grew twice as fast as housing, women were forced into work by the men's low wages, and the state could not provide adequate nurseries or kindergartens.

Following Stalinist directives, the Hungarian Workers' Party under Party Secretary Mátyás Rákosi began to build "a country of iron and steel," despite the fact that there were no iron ore deposits in Hungary, nor enough coking coal for their purposes, yet, perhaps to become a modern industrial power in Europe, invested in these energy-intensive and expensive projects that created bottlenecks for all other recovery efforts. On top of this, pushed by the Korean War and prodded by the Cold War, Hungary entered the Warsaw Treaty Organization and agreed to maintain 150,000 troops, a fantastic number given there were only 40,000 at the time.

In word, deed, and failure, Stalinism pervaded the economy. Not content with underfulfillment of the original five-year plan, the party raised targets so that, compared to 1949, as noted in chapter two, production by 1954 would go up by 200% instead of the original 86%, heavy industry would improve by 280% instead of 104%, and the light

industry would go up by 145% instead of 73%, on top of which collectivization had begun. Hungary, a country with inadequate housing and poor infrastructure, instead prioritized mining, metallurgy, and heavy manufacture, and the establishment of new Socialist cities—company towns—that were vulnerable to sectoral failure.

The socialist cities established in Hungary at the beginning of the 1950s were Sztálinváros (today Dunaújváros), Kazincbarcika (1954, and its Borsod Chemical Combine), Komló (1951, coal mining), and Tatabánya (1947, also coal, but later machine tools, textiles, and telecommunications); the surrounding areas were environmentally degraded by the construction. Sztálinváros had no industrial roots and was built completely from scratch on an agricultural site near the border of the village of Dunapentele to replace and augment outdated factories in Ózd, Salgótarján, Diósgyőr, and Csepel. If steel temporarily did well—on coke and ore from thousands of kilometers away—then housing, schools, kindergartens, nurseries, hospitals, cinemas, bakeries and slaughterhouses all lagged, as did public utilities, roads, and parks.

Sztalinvaros was for party loyalists a beacon of a socialist industrial future, but for peasants it symbolized an attack on their way of life. One thousand construction workers arrived in May 1950. Those arriving sought to escape the poverty, high taxes, compulsory grain deliveries, and dislocation in the countryside like the Russian peasants who fled to Magnitogorsk to avoid de-kulakization (the process of dispossessing allegedly wealthier peasants from their land and property, often forcing them into exile). The locals deeply resented the new arrivals. Still, by Christmas, 5,860 workers had joined the construction site, and by January 1952 over fourteen thousand laborers were at work. Like at Magnitogorsk, Sztalinvaros, as Pittaway writes, was “a workshop of chaos, low wages, despotic management, and poor working conditions.” Facing constant exhortation to meet impossible targets, the workers felt not in the least a part of the glorious communist future. And like throughout Eastern Europe, the Communist Party alienated them in new city designs that excluded a church from the city center; these were deeply religious peasants being forced to adopt a new worldview, suddenly if not violently. They resented the recruiters who had destroyed their way of life.⁴⁵

In this environment, Lysenkoism had a great influence. The August–September 1948 issue of *Társadalmi Szemle*, the scientific journal of the Hungarian Workers’ Party, published the Soviet Communist Party’s Central Committee–approved version of Lysenko’s August

1948 victory speech (over “hostile bourgeois genetics”) at the Lenin Academy of Agricultural Sciences. The new Hungarian agronomy journal was “Lysenkoized” from its first number in February 1949 in which it published: “A szovjet agrobiológiáról” [On Soviet Agrobiology] and was followed by the publication of selected papers by Lysenko and Michurin. Lysenkoism was introduced in colleges and universities as early as 1949 then into elementary and middle-school curricula by 1950. In scientific research institutes, Soviet Lysenkoists proselytized the new doctrine that rejected genetics. As in the USSR, Lysenkoists assumed all positions of power in ministries, research institutes, and scientific associations, almost without exception. Plant biology suffered greatly, if stockbreeders managed to survive.

With the rise of Lysenkoism, the Agricultural and Cooperative Committee of the Hungarian Workers’ Party helped to set agricultural research policies and further centralized agricultural research in 1950. It turned all ten Hungarian agricultural schools into experimental farms for Lysenkoist study of soil, crops, and technology. The Soviet model led to such new crops as cotton, rivet wheat, kenaf, tea, peanuts, and citrus fruit. Crop production would grow by 35 percent and stockbreeding by 50 percent during the first five-year plan. The introduction of non-native plants—no doubt well-adapted to the Hungarian environment—would follow to meet the expected demand of textile and food industries. Those scholars who were not convinced of vernalization and other practices were accused of lacking appropriate class consciousness or doing “ivory-tower” work not of benefit to the proletariat.

The experience with cotton gives a sense of how Stalinist transformation, Lysenkoism, and the geopolitics of subjugation to the Warsaw Pact (signed in 1955 to keep East European troops under Soviet direction as a military balance to NATO) determined the extent of Hungary’s cotton culture. Officials admitted that soils ill-suited to cotton and cold weather might prevent cotton culture from taking root. The absence of warm weather and sunshine in the Hungarian project was like Brezhnev’s efforts in Central Asia to grow cotton, which ignored the absence of water and other crucial climatic conditions.⁴⁶ But politics determined that planting begin experimentally on 22 hectares of land in 1948. Later that year the National Cotton Production Company was established in order to implement large-scale cotton production on over 50,000 hectares of land by the end of the plan. Nothing went right: costs of production were six times higher than value, while frosts and rain destroyed yields. Cotton required manual labor, and the small labor forces at

most farms required the recruitment of additional workers who were instead being siphoned off to Socialist cities. The decision to require labor on Sundays faltered because religious peasants refused to work. Students were recruited, and then children. But their transportation to the region was poorly organized, and their food and barracks were miserable. In the fields, not surprisingly, weeds spread. Some collective farms actively began to resist cotton. On top of this, some of the cotton fields were near the border; this required special permits for workers to approach border zones. Shockingly, weather forecasts were classified as a military secret, so farms had to guess when to plant and tend. In spite of this, in spring 1951 cotton production was expanded to four northern counties. Socialist Hungary went through all of this turmoil because of the desire for autarky and because the “fraternal” East European COMECON (Council of Mutual Economic Assistance) nations were required to produce cotton for their big brothers in Moscow; a patriarchal relationship rather than one of camaraderie seemed to prevail.

Yet Hungarian Communists were not to be deterred by soil, climate, or outmoded peasant traditions. All would have to be transformed. Another failed product was the yellow dandelion, a distant cousin of the “rubber” dandelion of Soviet Central Asia, which had been studied before World War II. Scientists established experimental farms for the rubber dandelion. The crop became public through a publicity campaign about how Soviet research would allow it to grow in Hungarian soil. Optimism was not justified; as with cotton, climate, inexperience, the necessity for labor-intensive cultivation, and overconfidence destroyed the crop. Nor could a National Rubber Crop Production Company, established in 1951, and assisted by Soviet advisors, turn the thing around. Kenaf, an industrial fiber to replace jute, and citrus also withered in the fields.

Rice should have turned out differently; rice culture dates back centuries to the Turkish occupation. By the end of the three-year plan, rice was being produced on over 20,000 hectares of land. To expand production, water works (irrigation) would have to follow, and planners hoped to use land that was unsuitable for the cultivation of more delicate crops for rice production instead. Planners set their sights on parts of the Great Hungarian Plain, including fields of Hortobágy, a national park of steppe and grassy plain. But irrigation fell far behind targets, the rice required far more effort to prepare soil, tend, and cultivate than officials contended, and environmental degradation was extensive. The state determined to force class enemies, exiles, and kulaks to work

the rice plantations. Work such as weeding required women to work barefoot in cold, shallow water. Eventually rice was eradicated from the fields, but the Hungarian landscape is still suffering.

At the beginning of the 1950s the East European socialist nations joined the USSR in devising plans to change the course of rivers in the name of “scientific management” of soil and water. Hungarian specialists turned in particular to the eastern territories, including the Tisza River basin. Rákosi referred in speeches to Soviet hero projects on the Volga, Dnieper, and Amu Darya rivers. He announced plans for the construction of a dam at Tiszalök on the Tisza River, and for irrigation systems, saying cotton might grow there with the application of Stalinist “science.” A number of aspects of the Socialist projects had pre-war roots. Under the new government, they moved ahead in fits and starts owing to ministerial debates on responsibility and authority. As in the USSR, a huge army of workers was required to carry out the Tiszalök project since the town there only had 4,500 inhabitants. The government brought in prisoners including “kulaks” who lived in labor camps and who provided most of the work force from 1951 to 1953. The dam was finished in 1954—on schedule—but produced electricity only in 1959. Other projects, for example the Danube–Tisza Canal, were left incomplete. Similar projects involved the Körös and Berettyó rivers, and mimicked the Soviet model of impossible goals and the refusal to admit defeat. Without sufficient labor or mechanization, these plans lurched forward.

An effort to build shelterbelts also began. The Hungarian Forestry Council set plans to nearly double forests, and included investment for saplings, public roads and railways, pastures, farmlands, farm centers, and settlements. Afforestation was a success story for a change, comprising 248,387 hectares of land between 1950 and 1960. Stalin’s hands therefore sit at the roots of Hungarian trees to this day.

Toward the end of the nature transformation, the Hungarian Party apparatus undertook a mass media campaign to ensure public support and the proper ideological messages. As in the USSR, party and scientific journals directed toward intellectuals published essays and Soviet propaganda on Lysenkoist and other Stalinist artifacts. The regime proselytized in good Stalinist fashion. Scientific journals published Hungarian and Soviet articles in translation that touted potential achievements and glorified Lysenkoism. Radio and newspapers were devoted to bringing the Stalinist gospel to the masses, especially those in the villages, although Radio Free Europe and Voice of America on

shortwave frequencies enabled the masses to learn from the West. As in the USSR, local officials installed speaker systems on the streets to reach citizens; many villages did not have these systems for a few years, so local public service announcements were publicized in the traditional way by drumming. The party organized militant, scientific lectures at Houses of Culture, which tens of thousands of people attended. Associations of scientists set up exhibitions at cinemas and railway stations, while short newsreels popularized agricultural innovations and Soviet technologies, including experiments with new non-native industrial crops in the spirit of Lysenko and Michurin's teachings, such as the claimed "success" of cotton. In addition to the constant coverage of cotton from planting to harvest, including Stakhanovite pickers, Sztálinváros and the Danube Iron Factory also became a constant focus in newsreels, as did how many bricks and how much concrete went into socialist industrialization. Heroic stories about the planting of tea, figs, and watermelon also indicated that man was in charge of weather. Changing the course of rivers was a Stalinist "monument to peace," while the imperialist states sought war. In all reports, the Soviet example served supreme—for example, the transformation of the Volga for the Tisza River that runs across the Great Hungarian Plain.

With the death of Stalin, the Stalinist Plan for the Transformation of Nature was mostly abandoned in Hungary, Poland, and Czechoslovakia. In Hungary the Central Committee of the Hungarian Workers' Party finally recognized the failure of Soviet programs in their country, and criticized industrial crop production for decreasing the farmland used for grains and for generally inadequate yields, although the committee also suggested one source of these problems was inadequate attention to Soviet scientific achievements and superior production knowledge. The Minister of State Farms and Forestry also recognized mistakes in agriculture, although did not refer extensively to nature transformation projects, which still held great promise among leaders. Still, cotton survived, perhaps because the Soviet Union made cotton production obligatory in all COMECON member states. At least the hands of Michurin or Lysenko were no longer needed to till Hungarian soil, and after 1956 Hungarian scholars essentially dropped reference to them and returned to genetics. When Lysenko visited Budapest in January 1960 he delivered a lecture to a packed hall at the Academy of Sciences, but refused to answer the two hundred questions addressed to him and lost all support among any remaining disciples. Lysenko's followers in Hungary gradually disappeared into their offices.

Stalin in Polish Nature

The Soviet dominance of politics, technology, and culture found full expression in the Stalin Palace of Culture and Science, built in Warsaw in the style of Moscow's eight postwar Stalinist skyscrapers. This was Moscow's skyline reproduced by Soviet architects under Lev Rudnev, not a "Polish" building. In fact, Polish Communists did not want the palace even as a press campaign praised it and the contribution of four thousand Russian workers, "brigades of enthusiasts," and "Soviet friends" who worked day and night using automated technology (from the civilized USSR, of course). The palace occupied a sixty-acre site that required the razing of a hundred houses and the displacement of four thousand people at a time of housing shortage in the Polish capital.⁴⁷ How did Stalinism extend to the polity, and from there to nature?

For Poland, too, the Red Army, Secret Police, and Polish Communists in exile in Moscow offices enabled the takeover orchestrated from the Kremlin that involved the gradual strangling of other parties and falsified elections. It helped at three summits between Stalin, Churchill, and the FDR that the Allies gave Stalin *carte blanche* to disassemble the country as he saw fit. Poland lost 20 percent of her territory. The country already faced huge problems: loss of wealth and infrastructure, and ten million people dead or in migration. The population grew rapidly over the next decades—but this put high demands on agriculture. Reconstruction was challenging due to shortages of investment income. They received little help through COMECON, which was Stalin's response to the Marshall Plan and a tool of Stalinization—it provided assistance for heavy industry, including armaments.

As elsewhere, the authorities imposed socialism on the economy. In Poland, small peasants received land taken from wealthier landowners, kulaks and "traitors," but in small enough plots to facilitate later collectivization. Eighty-five percent of forests were nationalized. Industry and other sectors of the economy followed. Elimination of opposition parties followed under Bolesław Bierut who headed the Polish United Workers' Party, the Communist Party of Poland, which ruled from 1948 to 1989 through a Soviet-style Politbureau. The party centralized all power, used terror and political police, and relied on a large number of Soviet advisors working in Polish institutions.

The major task beyond the organization of socialism was reconstruction through a 1947–49 three-year plan that essentially succeeded in part with Western help. The next six-year plan was typically Stalinist: it offered no breathing space in pursuit of heavy industry with such hero

projects as the Lenin Steelworks near Krakow, a massive chemical factory in Oświęcim, a mining and steel plant in Bolesław, automobile factories in Warsaw (Żerań) and in Lublin, and a power plant in Jaworzno. The party instituted collectivization with agricultural output to increase by 35–45 percent, with more cereals, potatoes, white rye, barley and oats, vegetables and fruit, and livestock and fodder.

The Poles had to rebuild science in terms of personnel and institutes, too, especially since they lost researchers and institutes in Vilnius (to Lithuania) and Lviv (to Ukraine). An assault against the autonomy of researchers and the alleged underestimation of the achievements of Soviet science under the great leadership of Stalin accompanied this rebuilding. Structurally, Polish education and science mirrored the Soviet model of universities, Academy of Science, and branch institutes. The Polish Academy of Sciences, with its 150-year tradition, was reborn in 1951 with a declaration of the need to resist “cosmopolitanism” (Western influences) and an acknowledgement of the glories of Soviet science. A series of agricultural institutes were reformed, restructured, or established at this time, as well including the Institute of Soil Science and Plant Cultivation, the Plant Breeding and Acclimatization Institute, and the Institute for Land Reclamation and Grassland Farming all under the Ministry of Agriculture, and forestry research centers in the Ministry of Forestry. Together with the Academy of Sciences, these institutes pursued Stalin’s “inspirational” plan for the transformation of nature. Given the destruction of Polish science under the Nazis, and then its isolation from European and North American science under socialism, it is not surprising that “Stalinist” science found broad support in Poland, without the repression that buffeted Soviet genetics.

The Stalin Plan found avid followers in such Polish party publications as *Nowe Drogi* as well as among scientists, including their Michurinist–Lysenkoist ideas. But many scholars found it better only to write about Lysenkoism, but not to apply the results of this work in practice so as to retain scientific independence; this made his influence fleeting. Other specialists, including biologists, botanists, foresters, and agronomists, promoted the new biology in support of nature transformation that was proselytized at various congresses and meetings.

In Poland the afforestation of fallow lands turned out well, while geo-engineering projects (canals, weirs and the like) failed. One reason for the success of the former was that forest shelter belts already had a long history in Poland, and several scholars considered the Stalinist plan in a positive light—but urged caution against a full embrace of forest belts

on any grand scale—while others noted their benefit in the struggle against draught and wind, yet only after detailed studies on climate, field conditions, soils, and so on. One of the causes of the limited reception of Stalin’s plan in Poland may have been the country’s own widespread tradition of nature conservation, which dated from the beginning of the twentieth century and continued under socialism, as can be seen in the creation or re-establishment of a series of national parks.

No less than in Czechoslovakia and Hungary, the Polish masses learned a great deal about the glories of Stalinist nature transformation through the press, popular science publications, radio, newsreels, numerous books and brochures, lecture series and the like. Socialist realist literature touted the glories of Stalinist geoengineering. But what of actual geoengineering in Poland—the construction of canals, dams, water power plants; land amelioration projects; and irrigation works? As in the other Socialist countries, including the USSR, many of the projects dated to an earlier era and had adherents among engineers from the “bourgeois era.” These engineers welcomed the interest of the government in their projects, and especially in the government’s largesse, even if it was socialist. But water resources in Poland were relatively scarce, so large-scale projects could not be pursued even if engineers were interested in them. The Czorsztyn, Rożnów, and Goczałkowice reservoirs, and the hugely expensive Wieprz-Krzna Canal, all of which had pre-war antecedents, were built under socialist rule and all of them had significant negative environmental impacts.

If Lysenkoism did not take complete hold, then Polish specialists still embraced the prospect of revolutionizing agriculture. The utopian scientific thoughts of Stalinism and fascination with Soviet achievements led Poles to introduce exotic plants to large-scale farming. Such plants as rice, citruses, corn, special varieties of wheat, soya, oilseed crops (castor oil plant and sunflowers) were supposed to be acclimated. Plant acclimation was also taken up by amateur clubs in Poland, usually at schools that were set as imitations of young Michurinist clubs in the Soviet Union. The aim was to recreate the new biology achievements on a small scale where young people could learn new theories, pursue experimental cultivation of rice, other exotic plants, and medical plants, undertake wheat improvement procedures, and master grafting techniques.

Stalin’s death, and that of Bierut, led to reforms (like in the USSR under Khrushchev, the “Gomulka Thaw”) when matters of science, industry, and agriculture took on a decidedly less ideological tone,

although Poland remained firmly in the socialist world. Khrushchev, however, remained in the thrall of Lysenko and of corn (a remarkably costly and failed effort), and he insisted that the Poles follow these approaches; he proselytized the glories of corn, insisting on its cultivation in Poland. But corn planting was never substantial, likely because it was inappropriate for the climate.

Ultimately, Stalinist transformation of nature never found full geo-engineering flower in Poland. But grotesquely costly projects with significant environmental costs that were typically “socialist”—large-scale industrial settings that were designed with inadequate concern for public health and safety and that polluted significantly—were pursued as they were elsewhere in socialist Eastern Europe, especially in such hero industrial cities as Krakow. If socialist Poland was not immune to efforts to turn small-scale agriculture and dilapidated industry into modern powerhouses of production, Poland’s natural environment was not directly subjugated to transformationist plans: there was no need for forest belts; economic recovery of cereal crops was more important than transformation; and collectivization did not go as far as in the USSR.

Building a Socialist Future

Major nature transformation projects were not unique to the USSR and Eastern Europe. They have many counterparts both in the socialist world and in the capitalist world. Among notable ones were a series of projects in the American West stretching from the Mississippi River basin to the Columbia and Colorado rivers, and to the Central Valley Project in California. Building on a series of earlier canals, river basin transfers, and irrigation projects in the eastern states in the early 1800s, specialists from the Army Corps of Engineers and later the Bureau of Reclamation moved westward, embracing more and more extensive and hubristic projects, and seeking to turn the plains and deserts into sites of urban development, electrical power generation, and massive farms of fruit, vegetables, and grain stretching to the horizon.

In the late nineteenth century, the Army Corps engaged in a series of grandiose projects to tame the Mississippi River, reclaim wetlands along its flood plain, and channel the river through levees in a futile attempt to increase farmland while preventing floods. In the attempt, having destroyed wetlands that served as “sponges” for floodwaters and created a human-built environment right up to the river banks,

they turned 100-year floods into 50-year events, and 50-year floods into 10-year events, each year with increasing losses and property damage. The Great Flood of 1927 covered 70,000 km² of land when levees failed, and it killed hundreds of people. Issues of race played out, too, as the corps used dynamite to blow up levees to direct water away from the wealthier neighborhoods and into poorer ones, including many of African Americans, and the National Guard use violence to force blacks to work in dangerous conditions to shore up some levees. Continued efforts to control nature with billions of dollars of geoengineering did not solve the problem, but always led to another flood or disaster. In 2005 Hurricane Katrina flooded New Orleans and other low-lying areas, killing roughly two thousand people and causing \$81 billion in damage.

Nature transformation was also prominent in the western states. Along the Columbia (and Snake) River, engineers and workers erected thirteen major hydroelectric power stations and built major irrigation systems to transform arid eastern Washington and Oregon into fruit and vegetable regions now dominated by agribusinesses. But the culmination of projects of geoengineering grandeur was likely the Central Valley Project in California, which had begun in the 1930s. It runs roughly north to south from Sacramento to Los Angeles, resulting in 1.2 million hectares of irrigated land; it includes a series of major dams and hydroelectric power stations, and has had significant environmental impacts, while at the same time creating tens of thousands of low-paying jobs in agriculture.⁴⁸

An environmental catastrophe that resulted from the overconfident determination to mold nature into a machine—and profit from it—was the Dust Bowl in the 1930s in which 400,000 km² of land in the plains states, in particular Texas and Oklahoma, but also New Mexico, Colorado, Kansas, and elsewhere, was blown away in terrible wind storms brought about in part by drought, but also by extensive deep plowing of grasslands with newly ubiquitous tractors and combine harvesters that were intended instead to create monocultures of wheat and grain for businesses.⁴⁹

China has also pursued, for thousands of years, various nature transformation projects, but especially magnificent and heinous ones in the early Communist period under Mao Tse-Tung.⁵⁰ One of the most audacious and costly was the Three Gorges Dam, built late in the twentieth century, operational at 22,000 MW in the twenty-first century, with roots dating to the Nationalist period at the beginning of the nineteenth

century, involving Bureau of Reclamation officials in the 1940s and Soviet officials in the 1950s and 1960s, with a reservoir of 1,045 square kilometers. Intended to prevent flooding and generate electricity, the dam resulted in the ousting of 1.5 million residents from their homes in the inundated Yangtze River basin. But water does not make it to many regions in China, setting up a situation like that in the United States in the 1930s and even worse—with the threat of desertification because of geoengineering. In northern China at the beginning of the twenty-first century a dust bowl also spreads across grasslands that have been hurriedly transformed into cattle farms; twenty-four thousand villages have already been abandoned as dust storms increase in frequency.

Given the fertile environment for the transformation of nature in the USSR, the heroic nature of plans, the unbridled enthusiasm of their Soviet promoters, and the determination of the Stalinists to see a copy of Soviet political and ideological precepts, economic plans, and transformationist visions imposed on the East European socialist landscape, why, then did transformation fail to play out on the grandiose Stalinist scale?

First, even with the presence of Soviet and Warsaw Pact troops after World War II, the nations preserved a great deal of autonomy in domestic affairs that reflected diverse social, political, and economic conditions. Several countries had more developed industries; others had a larger percentage of students with higher education; others' leaders were more openly "Stalinist"; and so on.

Second, while Soviet planners might with great latitude look across a great landmass on a map and see no borders—only natural barriers that they could dynamite, excavate, or ignore—and they certainly did not fear the opposition of local residents or indigenous peoples to their plans, East European officials had to consider their neighbors in Europe, not to mention the fact that private ownership still played a role in these economies to a certain extent. Surely, however, in all of these nations, the loss of the sanctity of private property enabled planners to draw lines across maps with impunity and never fear legal obstacles—and false barriers—to their plans. In the USSR, where state ownership dated back to 1917, with one-half of the world's forests and one-sixth of the world's landmass, it was a simpler matter to imagine industrial forest shelter belts or a 6,000 square kilometer reservoir.

Third, only recently had the scientific R & D and educational apparatuses been coercively converted to Stalinist models. While many leading specialists embraced "Michurinist" biology and welcomed the

opportunity to pursue transformationist projects, many others recognized that “proletarian” science in many ways was false science or “hurried” science, and that the pressure on them to achieve applications “impossible” under capitalism was based on false hopes and risky propositions. How could they simply ignore ecology and agronomy, push soil, plant trees, change the course of rivers, and make cotton and citrus grow where peasants knew it was impossible? It may also be that interagency and intergovernmental disputes slowed Stalinist transformation in Eastern Europe. After all, how could the ministries of fisheries tolerate dams and weirs going up willy-nilly on rivers? How could ministries of agriculture be happy with reservoirs that inundated farmland? And how could any one ministry compete for funds for its investment projects if there were so many hulking large projects to pursue to take funds toward nature transformation?

Nature transformation did not slow in the USSR after the death of Stalin. Khrushchev pursued the costly Virgin Lands campaign to plow under 20 million hectares of land, a project that attracted three hundred thousand Communist Youth league enthusiasts. He pushed the planting of corn. If progress had been slow to transform Siberia, then it accelerated under Khrushchev and Brezhnev in the enormous effort to locate new industry far from seemingly permeable western borders. Massive industrial combines to extract mineral resources and produce steel and chemicals appeared, linked by railways: Kuznetsk on the Tom River, Kemerovo, Anzherodzhensk, Prokop’evsk, and others to harvest coal, iron, zinc, tin, copper, aluminum, beryllium, and molybdenum. Forests fell to lumberjacks although they were only armed with rudimentary equipment. Hydroelectric power stations were built on the Ob, Irtysh, Angara, and Amur rivers.

In the socialist world, economic development was the *raison d’être* of regimes. Planners believed they could ignore geography, climate, and nature, and make them buckle to the dictates of the plan. Thus they ignored the social displacement and environmental costs of their programs from industry to agriculture to nature transformation projects. But without Stalin and a Stalinist polity, and with the abandonment of the threats of a coercive secret police and labor camps, transformation was scaled back by the late 1950s.

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Notes

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- 2 On the role of innocent men and women—prisoners of Stalinism—in the construction of the mighty symbols of the Stalinist Plan, see O.V. Lavinskaia and Iu. G. Orlova (eds), *Zakliuchennyye na Stroikakh Kommunizma. Gulag i Ob"ekty Energetiki v SSSR. Sobranie Dokumentov i Fotografii*, Moscow, 2008.
- 3 S. Brain, *Song of the Forest*, 140–67. See L. Graham, *The Ghost of the Executed Engineer*, Cambridge, 1993, for a discussion of the ‘disincentives’ to scientific dispute and dissent in the Stalinist USSR.
- 4 Dennis Shaw has worked on the scientific underpinnings of the Stalinist Plan. He notes that “proponents of the plan, Party propagandists and academic commentators . . . claimed that the scientific basis of the plan lay in the research of nineteenth- and early twentieth-century scholars like V.V. Dokuchaev, P.A. Kostychev, G.N. Vysotskii and V.R. Vil'yams.” They did this to give the impression that the plan was not “introduced in conditions of post-war crisis, [but] had a solid scientific basis.” The evidence indicates a hurried, enthusiastic embrace of hubristic ideas, not an understanding of the natural environment. See D. Shaw, “The Science behind the Great Stalin Plan (1948–1953): Nineteenth- and Early Twentieth-Century Precedents,” 24 July 2013. <http://www.ichstm2013.com/programme/guide/p/0721.html> (accessed 14 March 2015).
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- 7 F.P. Koshelev, *Velichestvennyye Stalinskii Stroiki Kommunizma i Ikh Narodnohoziistvennoe Znachenie*, Moscow, 1952, 68–69.
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- 19 Kasimovski, *Velikie Stroiki*, 44–45.
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- 22 P. Köhler, “Zarys historii lysenkizmu w ZSRR,” in *Studia nad lysenkizmem w polskiej biologii*, ed. P. Köhler, Kraków, 2013, 16.
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