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Prison Ecology and Environmental Justice: Connections, Aberrations and Psychological Impacts

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Abstract: This paper explores the intersection between prison ecology and environmental justice, highlighting how the prison system is an integral part of broader dynamics of environmental exploitation and social inequality. Prisons are often located in remote areas, on contaminated sites, or near polluting industries, and they themselves contribute to local environmental degradation, pollution processes, and territorial marginalization.

The article introduces the concept of prison ecology, which examines the relationship between prisons and nature, revealing the environmental issues that occur within and around correctional facilities, and their impact on both inmates and the surrounding physical environment. The prison environment significantly affects the health, well-being, and risk of recidivism among incarcerated individuals.

The quality of environmental conditions in penal institutions can be framed within the discourse of environmental justice, broadening the understanding of ecological injustices as forms of systemic violence. From this perspective, environmental factors such as overcrowding, poor sanitation, inadequate lighting, lack of access to green spaces, noise, unclean water, unhealthy air, and insufficient climate protection directly influence the safety and stability of prison institutions, as well as negatively impact inmates' mental and physical health.

This paper offers an overview of recent studies on this topic, identified through literature searches using Google Scholar and PubMed. The analysis of these studies suggests that an ecocritical perspective on prisons is valuable for designing truly effective practices of repair, care, and social transformation. It is crucial that prison environments have to be designed and managed not only to ensure security but also to promote both internal and external environmental sustainability.

Keywords: Prison Ecology, Environmental Justice, Ecological Inequality, Prison System, Environmental Racism, Prison Ergonomics, Psychological Impacts.

1. Introduction

In recent decades, growing attention to environmental issues has led to the development of new interdisciplinary fields of study, including *prison ecology*—the analysis of interactions between the carceral environment and surrounding ecological systems. This area of research explores not only how prison facilities affect and impact the local territory, but also how environmental conditions within prisons influence the physical and psychological health of incarcerated individuals.

Prisons function much like a compact city within a single structure. Every aspect of *prison design*—from staffing to location—is critical. As Sean McConvill, co-author of the influential British book Prison Design, states: "Among these, undoubtedly, respect for the environment and the wise use of resources must have a positive impact on both staff and inmates"[1].

The concept of prison ecology was formally introduced in 2014, building upon the work of legal scholars, researchers, and prison reform activists in the United States. The *Prison Ecology Project* (PEP) was launched by the *Human Rights Defense Center* (HRDC), a non-profit organization advocating for the human rights of incarcerated individuals in U.S. detention facilities[2]. Paul Wright, HRDC's director, experienced these environmental challenges firsthand while serving time at McNeil Island prison in Washington State. The project aims to investigate, document, and act against the environmental degradation of prison facilities, which affects both the natural environment and the health of people living within or near them.

Over the past four decades, during the so-called prison boom—which saw the U.S. prison population increase by 700%—incarcerated individuals and their advocates have raised environmental concerns in local resistance movements against prison operations and the construction of new facilities. In many ways, the vast U.S. prison population has become a nation unto itself. Prisoners, former inmates, and their families share a collective experience akin to that of a cultural diaspora, dispersed across the country within carceral institutions. This reality affects not only those directly involved but also produces significant ecological consequences.

The environments surrounding prisons and the prisons themselves share common and unique characteristics—what we now call *prison ecology*. The environmental justice movement has increasingly focused on marginalized communities, including incarcerated populations, who experience systemic injustices not only socially, but also environmentally. Prison ecology thus serves as a lens useful to understand the often-overlooked connections between the management of carceral spaces, social inequality, and environmental dynamics.

On one hand, prisons are frequently located in ecologically vulnerable areas, contributing to negative impacts on local ecosystems and neighboring communities. On the other hand, the conditions of incarceration—including practices such as prolonged solitary confinement, poor air and water quality, and general environmental neglect—constitute forms of environmental violence that exacerbate the psychological and physical harm suffered by inmates.

Only through an integrated approach—one that considers environmental, social, and psychological dimensions—can we move toward models of justice that truly recognize and address the multiple forms of oppression experienced by incarcerated individuals.

To fully grasp prison ecology, one must first understand environmental justice. Once referred to as "environmental racism," environmental injustice remains a barrier that prevents low-income and disadvantaged individuals from enjoying a good quality of life[3]. The U.S. Environmental Protection Agency (EPA) defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

Environmental injustices often occur when sources of pollution—such as landfills or highways—are located near low-income neighborhoods or disadvantaged communities. Typically, government support is lacking when these areas face environmental challenges. Whether such outcomes are the result of intentional or unintentional discrimination remains debated, but the existence of disparity persists regardless of intent.

One common explanation of unintentional environmental injustice involves the *Not In My Backyard* (NIMBY) syndrome, which occurs when

communities with greater financial and political power—typically white, middle- or upper-class areas—successfully oppose the siting of undesirable facilities such as waste treatment plants, landfills, and highways near their neighborhoods[4]. These facilities must be built somewhere, and the result is often their placement near communities with less political influence, which then suffer from health problems, economic disadvantages, and reduced quality of life.

A documented relationship exists between the siting of toxic waste sites and prisons, and this is in part a result of the NIMBY phenomenon: no one wants toxic waste or prisons in their neighborhood[5].

2. Carceral Ecology: Some Aberrations

In recent years, the interdisciplinary fields of prison ergonomics and the psychopathology of incarceration have gained increasing relevance in the study of prison living conditions and their impact on inmates' mental health.

The number of individuals behind bars is staggering; according to the *World Prison Brief*, 10.35 million people are incarcerated worldwide[6,7].

Across the globe, incarcerated individuals are systematically exploited and deprived of their fundamental rights. In some prisons, there are documented cases of forced labor, coerced sterilization, lack of edible and nutritious food, and severe shortages of water and basic sanitation. Such dire conditions are not only unethical but also violate the United Nations Standard Minimum Rules for the Treatment of Prisoners (the Mandela Rules), which state that "no prisoner shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment, for which no circumstance whatsoever may be invoked as a justification[8]."

The *Annual Report of the Prison Environmental Justice Project*[2] documents numerous cases of environmental injustice occurring within the global prison system. A few examples are presented below:

The Shahr-e Rey prison (also known as Qarchak Women's Prison) in Iran—originally a poultry farm—was converted into a correctional facility in 2011. The area is saturated with the pungent odors of manure and livestock, intensified by the lack of proper ventilation. Women frequently suffer from respiratory problems and illnesses due to poor air quality, a situation exacerbated by the absence of medical care[9]. The prison's location, adjacent to the Tehran-Varamin highway, combined with extreme overcrowding, creates ideal conditions for bacterial proliferation and the spread of infectious diseases.

In several prisons in Cameroon, inmates are provided with buckets to use as toilets, which are then emptied into open gutters that flow into surrounding communities. Inmates have reported being charged money to use actual bathrooms[10].

In Egyptian prisons[2], prisoners often do not even have the option to pay for a toilet; they are given only a bucket in their cell, without water, which is emptied in the morning. Women using these buckets have reported extreme unhygienic conditions, leading to vaginal infections.

The deprivation of proper sanitation facilities and the use of buckets or plastic bags is not exclusive to these African nations. This phenomenon has been reported in countries such as Haiti, Sri Lanka, Jamaica, Kenya, Fiji, the Bahamas, and others[11].

Poor sanitation in many prisons around the world has led to outbreaks of disease. In Antigua and Barbuda, the use of bucket latrines in cells, lack of running water, the presence of stray animals inside facilities, and raw meat and feces on the floors have made prisons breeding grounds for illness[2]. In 2016, MRSA (a virulent staph infection), chickenpox, and numerous other diseases affected inmates in Antigua's prisons. In Kenya, inadequate ventilation, bucket toilets, and generally filthy conditions have caused outbreaks of scabies, tuberculosis, and diarrhea[2]. These cases exemplify a global pattern in which incarcerated individuals are forced to live in environmentally unjust conditions, and their right to health is effectively revoked upon incarceration.

Even in Italy, there are examples of detention facilities built in environmentally hazardous locations[12]. The prison of Santa Maria Capua Vetere, a town in southern Italy (Campania region), is located approximately 600 meters from a solid waste treatment and packaging plant (*Stabilimento Tritovagliatura e Imballaggio Rifiuti*). This facility processes both unsorted urban waste and the dry fraction from recycling collections. In October 2019, a fire broke out inside the plant's warehouse, releasing toxic dioxins and furans into the air. The resulting pollution made the

air unbreathable for hours, directly affecting inmates living just across from the waste facility.

These are just a few examples of how environmental conditions—both external and within prisons—constitute forms of violence and environmental injustice that are experienced through the bodies of the incarcerated[12].

3. The Internal Prison Environment: Carceral Ergonomics

Attention to the ergonomics of space, furnishings, and work processes can significantly contribute to the health and well-being of inmates. *Carceral ergonomics* focuses on the adequacy of physical environments and institutional structures in relation to the physical and psychological needs of incarcerated individuals. It emphasizes the necessity of targeted interventions to reduce discomfort and promote overall well-being[13, 14].

Recent studies also suggest that, when properly managed, shared cells may improve psychological well-being by reducing social isolation and fostering mutual support among inmates[15].

In the early phases of prison development, cells were basic and austere—small, often dark spaces designed for solitary confinement. Early prison systems prioritized isolation, with inmates spending the majority of their time alone. Prison reform began in the 18th century, based on the idea that solitude could lead to repentance and personal renewal. Prisons built between 1786 and 1792 introduced nighttime cell separation, coupled with daytime forced labor[16]. This combination of isolation and labor was intended to correct behavior and instill discipline.

Most early prison cells lacked essential facilities. Inmates had limited access to light, air, and sanitation. Isolation was meant to prevent communication among prisoners, reducing the risk of conspiracies and subversive behavior inside prison walls.

Between the mid-19th and early 20th centuries, prison architecture began to evolve significantly. The focus shifted from mere punishment to reform and rehabilitation. Cells began to incorporate more humane features, including improved lighting, ventilation, and access to sanitation.

Modern prison cells often integrate design elements aimed at improving inmate well-being. These cells are intended to be more comfortable and conducive to rehabilitation. In contemporary settings, the design and functionality of cells reflect updated penal philosophies focused on reintegration. They provide privacy while encouraging positive social interaction where appropriate[17].

Cells are meticulously designed with specific dimensions, security features, and selected materials to ensure safety and usability. These design elements play a critical role in the overall environment and functionality of the correctional system. Life in a prison cell is structured and highly regulated. Daily routines are governed by strict protocols around services, meals, and hygiene.

Cells vary in size and configuration but typically include a bed, a toilet, and a small sink. Inmates may possess a limited number of personal items, such as books or photos. Some cells have a small window for natural light. Access to communal showers and recreational areas is permitted at scheduled times. Recreational activities may include watching TV, reading, or using the prison library. Access depends on the inmate's behavior and the facility's resources.

3.1 Psychological Effects of Confinement

Cell confinement can have profound psychological effects[18]. It impacts mental health and can shape inmates' coping mechanisms. Confinement may trigger mental health issues such as anxiety, depression, and post-traumatic stress disorder (PTSD)[19, 20]. The lack of social interaction and environmental stimulation often leads to feelings of loneliness and helplessness. Solitary confinement, in particular, has been strongly associated with severe psychological consequences, as shown in the following studies:

• Systematic Review on the Psychological Effects of Solitary Confinement

A systematic review revealed that solitary confinement is linked to a range of negative psychological effects, including anxiety, depression, paranoia, hallucinations, and cognitive deterioration. These effects are more pronounced among inmates with pre-existing psychological vulnerabilities[21].

• Meta-analysis on Mental Illness and Solitary Confinement

A meta-analysis examined the relationship between mental health problems and the likelihood of being placed in solitary confinement. The results showed a moderate association (odds ratio of 1.62), indicating

that inmates with mental illness are significantly more likely to be subjected to isolation[22].

• U.S. Study on the Neurological Impact of Solitary Confinement

A study explored the neurological consequences of solitary confinement, finding that prolonged isolation may lead to significant neural changes, including reduced neuronal density—suggesting potentially irreversible brain damage[23].

Prolonged isolation can cause hallucinations, extreme mood swings, and cognitive impairments. Maximum-security units, where inmates endure strict isolation, are especially detrimental to mental health[24]. Research indicates that symptoms developed during isolation often persist long after release. The psychological impact of confinement is substantial and necessitates consideration in prison policy and reform.

Inmates frequently develop various coping mechanisms to manage the stress of incarceration. These can be either positive or negative. Positive strategies include reading, writing, and other creative pursuits that offer mental escape. Physical exercise is another effective strategy, helping reduce stress and preserve mental health. Conversely, negative coping mechanisms may include aggression, self-harm, and substance abuse. The lack of support systems in prisons often makes it difficult for inmates to adopt healthier strategies.

Support programs, including therapy and group activities, are essential in helping inmates develop more effective coping skills. Functional coping mechanisms can significantly mitigate the negative psychological effects of confinement and improve post-release adaptation[25, 26].

3.2 Design Innovation and Rehabilitation

Innovations in prison cell design now emphasize integrating technology and rehabilitative methods to enhance inmate well-being and safety. These changes aim to improve both daily life for inmates and the overall efficiency of prison management.

Scientific principles can greatly inform cell design. Applying ergonomic principles can make prison cells more comfortable and functional. Proper placement of furniture—such as beds and desks—can optimize space and reduce stress. Lighting is crucial: natural light helps to regulate sleep and improves mood, while artificial lighting should mimic daylight to minimize health issues linked to poor lighting.

Air quality is another essential factor. Good ventilation systems reduce disease transmission and promote overall well-being, particularly important in shared cells. Noise control is also critical to mental health. High noise levels can cause stress and sleep disturbances; the use of sound-absorbing materials can make cells quieter and more restful.

Privacy within the cell, without compromising safety, can enhance inmates' comfort. Simple partitions or curtains can provide a sense of personal space and dignity. Implementing such evidence-based solutions can result in safer, more humane prison environments.

For instance, *Halden Prison* in Norway demonstrates how thoughtful cell design can reflect rehabilitative goals[27]. This facility incorporates architecture and design principles that support rehabilitation, showing the positive impact of intentional, human-centered design in carceral spaces.

4. New Perspectives: Nature-Based and Sustainable Detention

Wiep Fokker is a member of the Restorative Justice team in the Netherlands and currently works on small-scale prison models with a specific focus on sustainability. In addition to her role in the project, she is also the co-founder of the Dutch organization *Plantje Voor Morgen*, which is committed to making Dutch prisons more sustainable through gardening programs and by increasing green spaces within detention facilities.

In the current context of climate crisis and rising operational costs, prisons—like all institutions—must take action to become more sustainable and reduce their environmental impact. Fokker advocates for *nature-based detention facilities* as an ecologically sustainable model for penal reform. The climate and biodiversity crises demand a sustainability commitment from every sector of society. Yet despite this urgency, the notion of sustainable incarceration remains underexplored in Europe.

Now is the time to closely examine the ecological sustainability of detention, which could play a key role in future penal reform through the promotion of *nature-based detention houses*. RESCALED, a European movement, supports replacing large-scale prisons with small-scale, community-integrated detention

houses. Their mission is to foster inclusive, safe, and sustainable societies[28, 29].

A prison's ecological impact can be reduced through both material and procedural innovations. On the material side, this includes changes to architectural design, energy systems, and food supply chains. On the procedural side, rethinking activities, transportation, and waste management can further decrease environmental harm. In this context, the concept of an *ecological footprint* becomes a useful metric for evaluating the environmental impact of detention centers, both locally and internationally.

For example, the ecological footprint has been calculated for the Dutch judicial system. This method estimates "the total land and sea area required to sustain an activity or population," including environmental impacts. It offers institutions valuable insights into consumption and production patterns. The goal of nature-based detention centers, therefore, would be to minimize ecological footprints while maximizing positive contributions to surrounding ecosystems.

From a design perspective, the architectural possibilities of nature-based detention houses are promising. These facilities could integrate *green facades*—a proven method for reducing air and surface temperatures. Examples of vertical forests, such as those designed by Italian architect Stefano Boeri, can already be found in various cities worldwide[30].

The integration of abundant green spaces in and around detention houses would not only combat biodiversity loss but also promote the well-being of both incarcerated individuals and prison staff. Simply having a view of natural settings—trees, plants, wooded areas—has been shown to reduce instances of self-harm and violence among incarcerated populations[31].

From a methodological standpoint, nature-based detention houses should emphasize *local collaboration, reciprocity*, and *circular economy* practices, aligning with models such as the "doughnut economy." Waste recycling should be encouraged both in living spaces and in work-related activities. Meal programs for incarcerated individuals could be made more sustainable by including more plant-based, locally grown, and environmentally friendly foods—ideally cultivated in on-site prison gardens. These changes would benefit not only the environment but also inmates' physical and mental health.

Examples of eco-sustainable prisons in Europe already exist. In Sweden, *Sollentuna Prison* was awarded the BREEAM Public Projects In-Use Award in 2019 for environmental excellence. BREEAM is an environmental assessment method managed by the UK-based Building Research Establishment (BRE)[32].

Another prominent example is *Bastøy Prison* in Norway, which uses solar panels for energy, produces its own food, and recycles all usable materials. These innovative approaches exemplify how sustainable, humane, and rehabilitative models of detention can be effectively implemented in real-world contexts.

5. Conclusions

Discussions on sustainability are increasingly intersecting with penal policy. New prisons are being constructed according to "green" industrial standards, with efforts underway to minimize the environmental damage of carceral buildings, introduce renewable energy initiatives, and offer incarcerated individuals employment and training in "green collar" jobs. There is an urgent need to incorporate the concept of prison ecology into multilevel environmental governance strategies, by promoting socio-ecological impact assessments in the design, renovation, and siting of correctional facilities. A useful future direction may involve the development of an international index to measure the ecological quality of prison environments, enabling the collection of comparable data and informing institutional policy decisions.

Extreme punishments, malnutrition and hunger, pollution and lack of sanitation, disease, and forced labor are widespread across carceral systems in many parts of the world. These conditions represent not only social and human rights violations but also clear cases of environmental injustice—many of these harms are intrinsically linked to broader damages inflicted upon natural ecosystems. Numerous structural changes are needed to reverse these trends and practices. Perhaps the first step is to shift the way society conceptualizes incarcerated individuals. Rethinking prison ecology also requires reexamining our broader ecological ethics—one that merges social justice, human rights, and collective responsibility toward ecosystems and vulnerable populations.

As a society, we must abandon the belief that crime justifies degrading and inhumane treatment—

especially given that many incarcerated individuals are awaiting trial or serving time for minor offenses. Emerging research on the benefits of nature in correctional settings demonstrates that access to green spaces has a measurable impact on wellbeing. The work of Dominique Moran, which documents a robust connection between access to natural environments in and around prison spaces (even when not directly visible) and prisoner wellbeing, has already been cited as a compelling argument for redesigning prison infrastructure.

To address prison ecology as an issue of environmental justice is to recognize the prison not merely as a space of confinement, but as a mirror of the environmental inequalities of our time. Sustainability in carceral institutions must be pursued not only on a technical level, but also through ethical and political frameworks. This requires shared transnational commitment, participatory practices, and new paradigms of environmental governance. The challenge lies in reimagining the prison as a reflection of society—seen "beyond the walls"—through a cultural and institutional transformation. Only then can prisons evolve from spaces of exclusion into environments of social and ecological regeneration.

Abbreviations

PEP: Prison Ecology Project
HRDC: Human Rights Defense Center
EPA: Environmental Protection Agency
NIMBY: Not in My Backyard
TSDF: Treatment, Storage, and Disposal Facilities
MRSA: Staphylococcus aureus meticillino-resistente
DSPT: Disturbo da Stress Post-Traumatico
BRE: Building Research Establishment

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