

The Seed and the Earth

Biotechnology and the Colonisation of Regeneration

by Vandana Shiva

In this concluding contribution to the material originally prepared for the 1991 Bangalore seminar on 'Women, Ecology and Health', now thoroughly revised and updated for this issue of Development Dialogue, Vandana Shiva, who directed the seminar, elaborates the concept of regeneration as one of central importance for the building and sustenance of living societies. She observes, however, that the processes of regeneration have been systematically hampered by patriarchal forms of thinking and patriarchal patterns of behaviour. In her analysis, she traces the origins of this devaluation of regeneration to the artificially constructed division between activity/spirituality/culture as typically male characteristics and passivity/materiality/nature as typically female characteristics, and shows how this dichotomy has been used to intrude into and colonise the field of regeneration. One example of this is how the concept of terra mater, mother earth, was transformed into an inert terra nullius. Another example is provided by the biotechnology revolution, robbing the seed of its fertility and self-generative capacity by colonising it both through technical means and through claimed intellectual property rights. As in the case of the colonisation of land, this appropriation of the life processes has had a serious impact on Third World agriculture and increasingly so since the introduction of patents on seeds. What were previously looked upon as gifts of nature, freely exchanged between farmers, have now been turned into patented commodities. And just as technology has transformed the seed from a living, renewable resource into a mere raw material, it has devalued women in a corresponding way. The medicalisation of reproduction has been linked to the mechanisation of the female body in which a set of fragmented and replaceable parts are managed by professional experts. While this medicalisation is most advanced in the US, it is also spreading to the Third World. As is the case with plant generation, where agriculture has moved from the Green Revolution technologies to biotechnology, a parallel shift is taking place in human reproduction: the relocation of knowledge and skills from the mother to the doctor is increasingly accentuated.

The ecological movement has tried to counteract these developments by emphasising that there is no separation between mind and body, culture and nature. Nature is, from the ecological perspective, inherent in the relationships and connections that provide the very conditions for our life and health. The politics of



connection and regeneration is one of solidarity with nature and an alternative to the politics of separatism and fragmentation, which is causing ecological destruction all over the world. Natural agriculture and natural childbirth involve human creativity and sensitivity emerging from partnership and participation, not separation. 'The politics of partnership with nature, as it is being shaped in the everyday life of women and communities, is a politics of rebuilding connections and of regeneration through dynamism and diversity.'

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Regeneration lies at the heart of life, and has been the central principle guiding sustainable societies; without renewal there can be no sustainability. However, modern industrial society has no time for thinking about regeneration, and therefore no space for living regeneratively. Its devaluation of the processes of regeneration are the cause of both the ecological crisis and the crisis of non-sustainability.

The continuity between regeneration in human and non-human nature that was the basis of all ancient world-views was broken by patriarchy. Man was separated from nature, and the creativity involved in processes of regeneration was denied. Creativity became the monopoly of men, who were considered to be engaged in 'production', while women were engaged in mere 'reproduction' or 'procreation' which, rather than being treated as *renewable* production, was looked upon as non-production.

Activity, as purely male, was constructed on the separation of the earth from the seed and on the association of an 'inert' and empty earth with the passivity of the female. The symbols of the seed and the earth therefore undergo a metamorphosis when cast in a patriarchal mould; with it are restructured gender relations and our perception of nature and its regeneration. This non-ecological view of nature and culture has formed the basis of patriarchal perceptions of gender roles in reproduction across religions and through the ages.

The passivity of the earth and the activity of the seed are patriarchal constructs. This gendered seed/earth metaphor is then applied to human production and reproduction to make the relationship of dominance of men over women appear 'natural'. But the 'naturalness' of this hierarchy is built on a material/spiritual dualism, with maleness artificially associated with pure spirit and femaleness constructed as merely material, bereft of spirit. As Bachofen has stated,

The triumph of paternity brings with it the liberation of the spirit from the manifestations of nature, a sublimation of human existence over the laws of material life. Maternity pertains to the physical side of man, the only thing he shares with animals; the paternal spiritual principle belongs to him alone. Triumphant paternity partakes of the heavenly light, while child-bearing motherhood is bound up with the earth that bears all things.¹

Central to the assumption of men's superiority over women in patriarchy is the social construct of passivity/materiality as female and animal, and activity/spirituality as male and distinctly human: this is reflected in dualisms like mind/body, with the mind being non-material, male and active, and the body physical, female and passive. It is also reflected in the dualism of culture/nature, and the assumption that men alone have access to culture as women are 'bound up with the earth that bears all things'.² What these artificial dichotomies obscure is that activity, not passivity, is nature's nature.

By focusing on seeds and women's bodies as sites of regeneration this contribution attempts to look at how the new biotechnologies are reproducing these old patriarchal divisions of activity/passivity, culture/nature. It will also examine how these dichotomies are then used as instruments of capitalist patriarchy to colonise the regeneration of plants and human beings. Finally, it is an effort towards reclaiming the activity and creativity of women and nature in a non-patriarchal mould by *decolonising* regeneration.

**New colonies, new
creation boundaries**

The land, the forests, the rivers, the oceans, the atmosphere have all been colonised, eroded and polluted. Capital now has to look for new colonies to invade and exploit for its further accumulation. These new colonies are, in my view, the interior spaces of the bodies of women, plants and animals.

The invasion and take-over of land as colonies was made possible through the technology of the gunboat; the invasion and takeover of the life of organisms as the new colonies is being made possible through the technology of genetic engineering.

Biotechnology, as the handmaiden of capital in the post-industrial era, makes it possible to colonise and control that which is autonomous, free and self-regenerative. Through reductionist science, capital goes where it has never been before. The fragmentation of reductionism opens up areas for exploitation and invasion. Technological development under capitalist patriarchy proceeds steadily from what it has already transformed and used up, driven by its predatory appetite, towards that which has still not been consumed. It is in this sense that the seed and women's bodies as sites of regenerative power are, in the eyes of capitalist patriarchy, among the last colonies.³

While ancient patriarchy used the symbol of the active seed and the passive earth, capitalist patriarchy, through the new biotechnologies, reconstitutes the seed as passive and locates activity and creativity in the engineering mind. The reconstitution of the seed from being a regenerative source of life into valueless raw material goes hand in hand with the devaluation of those who regenerate life *of* the seed, *through* the seed—that is the farmers and peasants of the Third World—just as the reconstitution of the earth from being a living system into mere matter went hand in hand with the devaluation of the contributions of non-European cultures and nature, when land began to be colonised 500 years ago.

**From *terra mater* to
*terra nullius***

All sustainable cultures, in their diversity, have viewed the earth as *terra mater*. The patriarchal construct of the passivity of the earth and the consequent creation of the colonial category of land as *terra nullius*, served two purposes: it denied the existence and prior rights of original inhabitants and negated the regenerative capacity and life processes of the earth.⁴ The decimation of indigenous peoples everywhere was justified morally on the grounds that they were not really human; they were part of the fauna. As Pilger has observed, the *Encyclopaedia Britannica* appeared to be in no doubt about this in the context of Australia: 'Man in Australia is an animal of prey. More ferocious than the lynx, the leopard, or the hyena, he devours his own people.'⁵ In another Australian textbook, *Triumph in the Tropics*, Australian aborigines were equated with their half-wild dogs.⁶ Being animals, the original Australians and Americans, the Africans and Asians possessed no rights as human beings. Their lands could be usurped as *terra nullius*—lands empty of people, 'vacant', 'waste' and 'unused'. The morality of the missions justified the military take-over of resources all over the world to serve imperial markets. European men were thus able to describe their invasions as 'discoveries', piracy and theft as 'trade', and extermination and enslavement as their 'civilising mission'.

Scientific missions colluded with religious missions to deny rights to nature. The rise of mechanical philosophy with the emergence of the scientific revolution was based on the destruction of concepts of a self-regenerative, self-organising nature which sustained all life. For Bacon, who is called the father of modern science, nature was no longer 'Mother' Nature, but a female nature, conquered by an aggressive masculine mind. As Carolyn Merchant points out, this transformation of nature from a living, nurturing mother to inert, dead and manipulable matter was eminently suited to the exploitation imperative of growing capitalism. The nurturing earth image acted as a cultural constraint on exploitation of nature. 'One does not readily slay a mother, dig her entrails or mutilate her body'. But the images of mastery and domination created by the Baconian programme and the scientific revolution removed all restraint and functioned as cultural sanctions for the denudation of nature.

The removal of animistic, organic, assumptions about the cosmos constituted the death of nature—the most far-reaching effect of the scientific revolution. Because nature was now viewed as a system of dead, inert particles moved by external, rather than inherent forces, the mechanical framework itself could legitimate the manipulation of nature. Moreover, as a conceptual framework, the mechanical order had associated with it a framework of values based on power, fully compatible with the directions taken by commercial capitalism.⁷

The construct of the inert earth began to be given a new and sinister significance as development denied the earth's productive capacity and created systems of agriculture which could not regenerate or sustain themselves.

Sustainable agriculture is based on the recycling of soil nutrients. This involves returning to the soil part of the nutrients that come from it and support plant growth. The maintenance of the nutrient cycle, and through it the fertility of the soil, is based on this inviolable law of return which recognises the earth as the source of fertility. The Green Revolution paradigm of agriculture substituted the regenerative nutrient cycle with linear flows of purchased inputs of chemical fertilisers from factories and marketed outputs of agricultural commodities. Fertility was no longer the property of soil but of chemicals. The Green Revolution was essentially based on 'miracle seeds' which needed chemical fertilisers and which did not produce plant outputs for returning to the soil.⁸ The earth was again viewed as an empty vessel for holding intensive inputs of irrigated water and chemical fertilisers. The 'activity' lay in the 'miracle' seeds which transcended nature's fertility cycles.

Ecologically, however, the earth and soil were not empty, and the growth of

Green Revolution varieties did not take place only with the seed-fertiliser packet. The creation of soil diseases and micro-nutrient deficiencies are an indication of the invisible demands the new varieties were making on the fertility of the soil; and desertification indicates the broken cycles of soil fertility caused by an agriculture that produces only for the market. The increase in production of grain for marketing was achieved in the Green Revolution strategy by reducing the biomass for internal use on the farm. The reduction of output for straw production was probably not considered a serious cost since chemical fertilisers were thought to be a total substitute for organic manure. Yet, as experience has shown, the fertility of soils cannot be reduced to NPK (nitrogen, phosphorus, potassium) in factories, and agricultural *productivity necessarily includes returning to the soil part of the biological products that the soil yields*. The seed and the earth mutually create conditions for each other's regeneration and renewal. Technologies cannot provide a *substitute* for nature and work outside nature's ecological processes without destroying the very basis of production, nor can markets provide the only measure of 'output' and 'yield'.

Biological products, which were not sold on the market but used as inputs for maintaining soil fertility, were totally ignored by the cost-benefit equations of the Green Revolution miracle. They did not appear in the list of inputs because they were not purchased, nor in the list of outputs because they were not sold. Yet what was seen as 'unproductive' or 'waste' in the commercial context of the Green Revolution is now emerging as productive in the ecological context and as the only route to sustainable agriculture. By treating essential organic inputs as 'waste', the Green Revolution strategy unwittingly ensured that fertile and productive soils were actually laid waste; the 'land-augmenting' technology has proved to be a land-degrading and land-destroying one. With the greenhouse effect and global warming, a new dimension has been added to the ecologically destructive effect of chemical fertilisers; nitrogen-based fertilisers release nitrous oxide, one of the greenhouse gases causing global warming, into the atmosphere. Chemical fertilisers have thus contributed to the erosion of food security through the pollution of land, water and the atmosphere.

From seeds of the earth to seeds of the lab

While the Green Revolution was based on the assumption that the earth is inert, the biotechnology revolution robs the seed of its fertility and self-regenerative capacities and colonises it in two major ways: firstly through technical means, and secondly through property rights. Processes like hybridisation are the technological means which stop seed from reproducing itself. This provides capital with an eminently effective way of circumvent-

ing natural constraints on the commodification of the seed. Hybrid varieties do not produce true-to-type seed, and farmers must return to the breeder each year for new seed stock.

To use Jack Kloppenburg's description of the seed: it is both a 'means of production' as well as a 'product'.⁹ Whether they are tribals engaged in 'shifting cultivation' or peasants practising settled agriculture, in planting each year's crop farmers also reproduce the necessary element of their means of production. The seed thus presents capital with a simple biological obstacle; given the appropriate conditions, it reproduces itself and multiplies. Modern plant-breeding has primarily been an attempt to remove this biological obstacle, and the new biotechnologies are the latest tools for transforming what is simultaneously a 'means of production' and a 'product' into mere 'raw material'.

The hybridisation of seed was an invasion into the seed itself. As Kloppenburg has stated, it broke the unity of seed as foodgrain and as a means of production. In doing so, it opened up the space for capital accumulation that private industry needed in order to control plant breeding and commercial seed production. And, it became the source of ecological disruption by transforming a self-regenerative process into a broken linear flow of supply of living seed as raw material and a reverse flow of seed commodities as products. The decoupling of seed from grain also changes the status of seed.

The commodified seed is ecologically incomplete and ruptured at two levels: (i) it does not *reproduce* itself, while by definition, seed is a regenerative resource. Genetic resources are thus, through technology, transformed from a renewable into a non-renewable resource; (ii) it does not *produce* by itself. It needs the help of other purchased inputs to produce. As the seed and chemical companies merge, the dependence on inputs will increase. Ecologically, whether a chemical is added externally or internally, it remains an external input in the ecological cycle of the reproduction of seed. It is this shift from ecological processes of production through regeneration to technological processes of non-regenerative production that underlies the dispossession of farmers and the drastic reduction of biological diversity in agriculture. It is at the root of the creation of poverty and of non-sustainability in agriculture.

Where technological means fail to prevent farmers from reproducing their own seed, legal regulation in the form of intellectual property rights and patents is brought in. Patents are central to the colonisation of plant regeneration and, like land titles, are based on the assumption of ownership and property. A vice president of Genentech has stated, 'When you have a

chance to write a clean slate, you can make some very basic claims, because the standard you are compared to is the state of prior art, and in biotechnology there just is not much.¹⁰ Ownership and property claims are made on living resources, but prior custody and use of those resources by farmers is not the measure against which the patent is set. Rather, it is the intervention of technology that determines the claim to their exclusive use, and the possession of this technology then becomes the reason for ownership by corporations and for the simultaneous dispossession and disenfranchisement of farmers. As *terra nullius* was divested of all prior rights, so are living resources now being divested.

As with the transformation of *terra mater* to *terra nullius*, the new biotechnologies rob farmers' seeds of life and value by the very process that makes corporate seeds the basis of wealth creation. Indigenous varieties, called landraces, evolved through both natural and human selection, and produced and used by Third World farmers worldwide, are 'primitive cultivars'; those varieties created by modern plant breeders in international research centres or by transnational seed corporations are called 'advanced' or 'elite'. Trevor Williams, the former Executive Secretary of IBPGR (International Board for Plant Genetic Resources) has argued that 'it is not the original material which produces cash returns' and a 1983 forum on plant breeding stated that 'raw germplasm only becomes valuable after considerable investment of time and money'.¹¹ According to this calculation, peasants' time is considered valueless and available for free. Once again a creation boundary is being arbitrarily determined to deny value to all prior processes of creation by defining them into nature. Thus, plant breeding by farmers is not breeding; it is only when farmers' varieties of 'primitive' germplasm are mixed or crossed with inbred lines in international labs by international scientists that 'creation' and 'innovation' are seen to happen:

At this point real plant breeding *begins*. That is, the long, laborious, expensive and always risky process of back crossing and other means required to first make genetic sense out of the chaos created by the foreign germplasm, and eventually make dollars and cents from a marketable product.¹²

But the landraces which farmers have developed are not genetically chaotic. They consist of improved and selected material, embodying the experience, inventiveness and hard work of farmers, past and present; and the evolutionary material processes they have undergone serve ecological and social needs. It is these needs that are undermined by the monopolising tendency of corporations. Placing the contribution of corporate scientists over and above the intellectual contribution made by Third World farmers over ten

thousand years, in the areas of conservation, breeding, domestication and development of plant and animal genetic resources, is based on rank social discrimination.

**Farmers' rights,
plant breeders'
rights and intellec-
tual property rights**

As Pat Mooney has argued, 'The perception that intellectual property is only recognisable when produced in laboratories by men in lab coats is fundamentally a racist view of scientific development',¹³ for the total genetic change achieved by farmers over millennia has been far greater than that achieved during the last hundred or two hundred years of more systematic science-based efforts. The limits of the market system in assigning value can hardly be a reason for denying value to farmers' seeds and nature's seeds. It indicates the deficiencies in the logic of the market rather than the status of the seed or of farmers' intelligence.

The denial of prior rights and creativity is essential for owning life. A brief book prepared by the biotechnology industry states:

Patent laws would in effect have drawn an imaginary line around your processes and products. If any one steps over that line to use, make or sell your inventions or even if someone steps over that line in using, making or selling his own products, you could sue for patent protection.¹⁴

Jack Doyle has appropriately remarked that patents are less concerned with innovation than with territory, and can act as instruments of territorial take-over by claiming exclusive access to creativity and innovation and thereby monopoly rights to ownership.¹⁵ The farmers who are the guardians of the germplasm have to be dispossessed to allow the new colonisation to happen.

As in the colonisation of land, the colonisation of life processes will have a serious impact on Third World agriculture. First, it will undermine the cultural and ethical fabric of our agriculturally based societies, in which fundamental life processes are not to be tampered with. With the introduction of patents, seeds—which have hitherto been treated as gifts and exchanged freely between farmers—will become patented commodities. Hans Leenders, former Secretary General of the International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL), has proposed the abolition of the farmer's right to save seed. He says,

Even though it has been a tradition in most countries that a farmer can save seed from his own crop, it is under the changing circumstances not equitable that farmers can use this seed and grow a commercial crop out of it without payment of a royalty ...: the seed industry will have to fight hard for a better kind of protection.¹⁶

Although genetic engineering and biotechnology only relocate existing genes rather than create new ones, the ability to relocate and separate is translated into the power and right to own; the power to own a part is then translated into control of the entire organism.

The corporate demand for the conversion of a common heritage into a commodity, and for profits generated through this transformation to be treated as property rights, has serious political and economic implications for Third World farmers. They will now be forced into a three-level relationship with the corporations demanding a monopoly on life forms and life processes through patents. First, farmers are *suppliers* of germplasm to transnational corporations; second, they become *competitors* in terms of innovation and rights to genetic resources; and third, they are *consumers* of the technological and industrial products of these corporations. Patent protection displaces the farmer as a competitor, transforms him into a supplier of free raw material, and makes him totally dependent on industrial supplies for vital inputs such as seed. Above all, the frantic cry for patent protection in agriculture is for **protection** from farmers, who are the original breeders and developers of biological resources in agriculture. It is argued that patent protection is essential for innovation, but what emerges is that it is essential only for that innovation that garners profit for corporate business; after all, farmers have been making innovations for centuries, as have public institutions for decades, without property rights or patent protection.

Further, unlike plant breeders' rights (PBRs) the new utility patents are very broad-based, allowing monopoly rights over individual genes and even over characteristics. PBRs do not entail ownership of the germplasm in the seeds, they only grant a monopoly right over the selling and marketing of a specific variety. Patents, on the other hand, allow for multiple claims that may cover not only whole plants, but plant parts and processes as well. So, according to attorney Anthony Diepenbrock, 'You could file for protection of a few varieties of crops, their macro-parts (flowers, fruits, seeds and so on), their micro-parts (cells, genes, plasmids and the like) and whatever novel processes you develop to work these parts, all using one multiple claim'.¹⁷

Patent protection implies the exclusion of farmers' rights over resources having these genes and characteristics. This will undermine the very foundations of agriculture. For example, a patent has been granted in the US to a biotechnology company, Sungene, for a sunflower variety with very high oleic acid content. The claim allowed was for the characteristic (i.e. high oleic acid) and not just for the genes producing the characteristic. Sungene

has notified others involved in sunflower breeding that the development of any variety high in oleic acid will be considered an infringement of its patent.

The landmark event for the patenting of plants was the 1985 judgment in the US, now famous as *ex pane Hibberd*, in which 'molecular genetics' scientist Kenneth Hibberd and his co-inventors 'were granted patents on the tissue culture, seed, and whole plant of a corn line selected from tissue culture'.¹⁸ The Hibberd application included over 260 separate claims, which give the molecular genetics scientists the right to exclude others from use of all 260 aspects. While Hibberd apparently provides a new legal context for corporate competition, the most profound impact will be felt in the competition between farmers and the seed industry.

As Kloppenburg has indicated, with Hibberd, a juridical framework is now in place that may allow the seed industry to realise one of its longest held and most cherished goals, that of forcing all farmers of any crop to buy seed every year instead of obtaining it through reproduction. Industrial patents allow the right to *use* the product, not to *make* it. Since seed makes itself, a strong utility patent for seed implies that a farmer purchasing patented seed would have the right to use (to grow) the seed, but not to make seed (to save and replant). If the Dunkel Draft of the General Agreement on Tariffs and Trade (GATT) is implemented, the farmer who saves and replants the seed of a patented or protected plant variety will be violating the law.

Through intellectual property rights an attempt is made to take away what belongs to nature, to farmers, to women, and to term this invasion 'improvement' and 'progress'. Violence and plunder as instruments of wealth creation do not just belong to the history of colonisation, which began 500 years ago with the early invasions; they are essential to the colonisation of nature and of our bodies through the new technologies. As before, those who are exploited become the criminals, those who exploit require protection. The North must be protected from the South so that it can continue its uninterrupted theft of the Third World's genetic diversity. The 'seed wars', trade wars, patent 'protection' and intellectual property rights at GATT are modern versions of claims to ownership through separation and fragmentation. The US International Trade Commission estimates that US industry is losing anything between USD 100 and 300 billion due to the absence of intellectual property rights. If this regime of 'rights' being demanded by the US comes into being, the transfer of funds from poor to rich countries will exacerbate the Third World crisis ten times over.¹⁹

The US has accused the Third World of 'piracy'. The estimates provided for royalties lost in agricultural chemicals are USD 202 million and USD 2,545 million for Pharmaceuticals.²⁰ However, as the team at RAFI, the Rural Advancement Foundation International, in Canada has shown, if the contribution of Third World peasants and tribals is taken into account, the roles are dramatically reversed: the US owes USD 302 million in royalties for agriculture and 5,097 million for Pharmaceuticals to Third World countries, according to these latter estimates. In other words, in these two biological industry sectors alone, the US owes 2.7 billion dollars to the Third World.²¹ It is to prevent these debts from being taken into account that it becomes essential to set up the creation boundary through the regulation of intellectual property rights; without it, the colonisation of the regenerative processes of life renewal is impossible. Yet if this too is allowed to happen in the name of patent protection, innovation and progress, life itself will have been colonised.

There are, at present, two trends reflecting different views as to how native seeds, indigenous knowledge and farmers' rights should be treated. On the one hand are initiatives across the world that recognise the inherent value of seeds and biodiversity, acknowledge the contribution of farmers to agricultural innovation and seed conservation, and see patents as a threat both to genetic diversity and to farmers. At the global level the most significant platforms to have made the issue of farmers' rights visible are the FAO Commission on Plant Genetic Resources²² and the Keystone Dialogue.²³ At the local level, communities all over Asia, Africa and Latin America are taking steps to save and regenerate their native seeds. Only to mention one example, we have in India set up a network called 'Navdanya' for the conservation of people's seeds.

Despite these initiatives, however, the dominant trend continues to be towards the displacement of local plant diversity and its substitution by patented varieties; at the same time, international agencies under pressure from seed corporations are pushing for regimes of intellectual property rights which deny farmers their intellect and their rights. The March 1991 revision of the International Convention for the Protection of New Varieties of Plants, for example, allows countries to remove the 'farmers' exemption'—the right to save and replant seed—at their discretion.²⁴

In another development leading to the privatisation of genetic resources, the Consultative Group on International Agricultural Research (CGIAR) made a policy statement on 22 May, 1992 allowing the privatisation and patenting of genetic resources held in international gene banks.²⁵ The strongest pressure for patents is coming from GATT, especially in relation

to the agreement on Trade Related Intellectual Property Rights (TRIPs) and Agriculture.²⁶

Engineering humans

Just as technology changes seed from a living, renewable resource into mere raw material, it devalues women in a similar way. The medicalisation of reproduction has been linked to the mechanisation of the female body in which a set of fragmented, fetishised and replaceable parts are managed by professional experts. While this medicalisation is most advanced in the US, it is also spreading to the Third World.

The mechanisation of childbirth is evident in the increased use of Caesarean sections. Significantly, this method, which requires the most 'management' by the doctor and the least 'labour' by the woman, is seen as providing the best product. But Caesarean sections are a surgical procedure, and the chances of complications are two to four times greater than during normal vaginal delivery. They were introduced as a means of delivering babies at risk but when they are done routinely, they can pose an unnecessary threat to health and even life. Close to one in every four Americans is now born by Caesarean section.²⁷ Brazil has one of the highest proportions of Caesarean section deliveries in the world; a nationwide study of patients enrolled in the social security system showed an increase in the proportion of Caesarean sections from 15 per cent in 1974 to 31 per cent in 1980. In urban areas, such as the city of Sao Paulo, rates as high as 75 per cent have been observed. However, in several European countries there is a counter trend, a return to home births and natural childbirth.

As with plant regeneration, where agriculture has moved from the Green Revolution technologies to biotechnology, so too with human reproduction, a parallel shift is taking place. With the introduction of new reproductive technologies, the relocation of knowledge and skills from the mother to the doctor, from women to men will be accentuated. Singer and Wells, in *Having Babies*, have suggested that the production of sperm is worth a great deal more than the production of eggs. They conclude that sperm vending places a greater strain on the man than egg 'donation' does on the woman. In spite of the chemical and mechanical invasion of her body.²⁸

While, currently, in vitro fertilisation (IVF) and other technologies are offered for 'abnormal' cases of infertility, the boundary between nature and non-nature is fluid and normality has a tendency to be redefined as abnormality, as technologies created for abnormal cases become more widely used. When pregnancy was first transformed into a medical disease, profes-

sional management was limited to abnormal cases, while normal cases continued to be looked after by the original professional, the midwife. While 70 per cent of childbirths were thought normal enough to be delivered at home in the UK in the 1930s, by the 1950s the same percentage were identified as abnormal enough to be delivered in hospital!

The old metaphor of women as the passive field is renewed with the new reproductive technologies. Medical developments have simply provided contemporary scientific rhetoric for the reassertion of an enduring set of deeply patriarchal beliefs. The idea of women as vessels, and the foetus as 'created' by the father's seed and owned by patriarchal right, leads logically to the breaking of organic links between the mother and the foetus.

Medical specialists, falsely believing that they 'produce' and 'create' babies, force their knowledge on knowing mothers. They treat their own knowledge as infallible, and women's knowledge as wild hysteria. And through their fragmented and invasive knowledge they create 'maternal foetal conflict' in which life is seen only in the foetus, and the mother is reduced to a potential criminal threatening her baby's life.

The medical construction of 'life' through technology is often inconsistent with the living experience of women as thinking and knowing human beings. When such conflicts arise, patriarchal science and law have worked hand in hand to establish the control by professional men over women's lives, as demonstrated by recent work on surrogacy and the new reproductive technologies. Women's rights, linked with their regenerative capacities, have been replaced by those of doctors as 'producers' and rich infertile couples as 'consumers'.

The woman whose body is being exploited as a machine is not seen as the one who needs protection from exploiting doctors and rich couples. Instead, the 'consumer', the adoptive male parent needs protection from the biological mother who has been reduced to a surrogate uterus, as in the famous Baby M. case, in which Mary Beth agreed to loan her uterus, but after experiencing what having a baby meant, wanted to return the money and keep the baby. However, a New Jersey judge ruled that a man's contract with a woman concerning his sperm is sacred and that pregnancy and childbirth are not. Commenting on this notion of 'justice', Phyllis Chesler, in her book *Sacred Bond*, says, 'It's as if these experts were 19th century missionaries and Mary Beth a particularly stubborn native who refused to convert to civilisation, and what's more, refused to let them plunder her natural resources without a fight.'²⁴

The role of man as creator has also been taken to absurd lengths in an application submitted for a patent for the characterisation of the gene sequence coding for human relaxin, a hormone which is synthesised and stored in female ovaries and helps in dilation, thus facilitating the birth process. A naturally occurring substance in women's bodies is thus being treated as an 'invention' of three male scientists. Peter John Hud. Hugh David Mill, and Geoffrey William Tregear.³⁰ 'Ownership' is thus acquired through invasive and fragmenting technology, and it is this link between fragmenting technology and control and ownership of resources and people that forms the basis of the patriarchal project of knowledge as power over others.

Such a project is based on the acceptance of three separations: (i) the separation of mind and body; (ii) the gendered separation of male activity as intellectual and female activity as biological; and (iii) the separation of the knower and the known. These separations allow the political construction of a creation boundary that divides the thinking, active male from the unthinking, passive female, and from nature.

Biotechnology is today's dominant cultural instrument for carving out the boundary between nature and culture through intellectual property rights and for defining women's and farmers' knowledge and work into nature. These patriarchal constructs are projected as natural although there is nothing natural about them. As Claudia von Werlhof has pointed out, from the dominant standpoint, 'nature' is everything that should be available free or as cheaply as possible. This includes the products of social labour. The labour of women and Third World farmers is said to be non-labour, mere biology, a natural resource; their products are thus akin to natural deposits.³¹

The production boundary and the creation boundary

The transformation of value into disvalue, labour into non-labour, knowledge, into non-knowledge, is achieved by two very powerful constructs, the production boundary and the creation boundary. The production boundary is a political construct which excludes regenerative, renewable production cycles from the domain of production. National accounting systems which are used for calculating growth through gross national product are based on the assumption that if producers consume what they produce, they do not in fact produce at all, because they fall outside the production boundary.¹² All women who produce for their families, children and nature are thus all treated as non-productive, as economically inactive. Discussions at the UN Conference on Environment and Development (UNCED) on issues of biodiversity have also referred to production for own consumption as a "mar-

ket failure' (Agenda 21).³³ Self-sufficiency in the economic domain is therefore seen as economic deficiency when economies are confined to the market place. The devaluation of women's work, and of work done in subsistence economies in the Third World, is the natural outcome of a production boundary constructed by capitalist patriarchy.

The creation boundary does to knowledge what the production boundary does to work: it excludes the creative contributions of women and Third World peasants and tribals and treats them as being engaged in unthinking, repetitive, biological processes. The separation of production from reproduction, the characterisation of the former as economic and the latter as biological, are some of the underlying assumptions that are treated as 'natural' even though they have been socially and politically constructed.

This patriarchal shift in the creation boundary is misplaced for many reasons. First, the assumption that male activity is true creation because it takes place *ex nihilo* is ecologically false. No technological artefact or industrial commodity is formed out of nothing; no industrial process takes place where nothing was before. Nature and its creativity and other people's social labour are consumed at every level of industrial production as 'raw material' or 'energy'. The biotech seed which is treated as 'creation' to be protected by patents could not exist without the farmer's seed. The assumption that only industrial production is truly creative because it produces from nothing hides the ecological destruction that goes with it. The patriarchal creation boundary allows ecological destruction to be perceived as creation, and ecological regeneration and creation to be perceived as non-creation. This devaluing of regeneration underlies the breakdown of ecological cycles and the crisis of sustainability. To sustain life means, above all, to regenerate life: but according to the patriarchal view, to regenerate is *not* to create, it is merely to 'repeat'.

Such a definition of creativity is also false because it fails to see that women's and subsistence producers' work go into child rearing and cultivation, and because their knowledge and work are based on participation they make for the conservation of regenerative capacity.

The assumption of creation as the production of novelty is also false because no regeneration is mere repetition. It involves diversity, while engineering produces uniformity. Regeneration is how diversity is produced and renewed, in fact. While no industrial process takes place out of nothing, the creation myth of patriarchy is particularly unfounded in the case of biotechnologies where life forms are the 'raw material' for industrial production.

Rebuilding connections

The source of patriarchal power over women and nature lies in separation and fragmentation. Nature is separated from and subjugated to culture; mind is separated from and elevated above matter; female is separated from male, and identified with nature and matter. The domination over women and nature is one outcome, the disruption of cycles of regeneration is another; disease and ecological destruction arise from this interruption of the cycles of renewal of life and health. The crisis of health and ecology suggests that the assumption of man's ability to totally engineer the world, including seeds and women's bodies, is in question. Nature is not the essentialised passive construct that patriarchy assumes it to be. Ecology forces us to recognise the disharmonies and harmonies in our interactions with nature. Understanding and sensing connections and relationships is the ecological imperative.

The main contribution of the ecology movement has been the awareness that there is no separation between mind and body, human and nature. Nature is constituted in the relationships and connections that provide the very conditions for our life and health. This politics of connection and regeneration provides an alternative to the politics of separation and fragmentation that are causing ecological breakdown, and is one of solidarity with nature. This implies a radical transformation of nature and culture such that they are mutually permeating, not separate and oppositional. By stating a partnership with nature in the politics of regeneration, women are simultaneously reclaiming their own and nature's activity and creativity. There is nothing essentialist about this politics because it is, in fact, based on denying the patriarchal definition of passivity as the essence of women and nature. There is nothing absolutist about it because the 'natural' is constructed through diverse relationships in diverse settings. Natural agriculture and natural childbirth involve human creativity and sensitivity of the highest order, a creativity and knowledge emerging from partnership and participation, not separation. The politics of partnership with nature, as it is being shaped in the everyday lives of women and communities, is a politics of rebuilding connections and of regeneration through dynamism and diversity.

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